Electric Industrial Trucks in Freight Handling—
Savings in Time and Labor Requirements at Railroad Terminals.

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Electrical World

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Electrical World

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Give Good Service

SERIOUS as coal conditions are, it is not a time for recrimination. We are at war; the demand for energy is tremendously intensified by the military needs of the nation. It is not a question of what might have been done, the problem is too insistent for that. Coal famine stalks throughout the land. What is the central station going to do about it now? Knowing the temper of operators and executives and holding to the best traditions of the industry, the ELECTRICAL WORLD feels confident that superhuman efforts will be made to maintain good service.

In the last week we have seen the outward manifestation of what every observing man in the industry knew must come to pass unless the situation was controlled by a strong hand. Coal production is far short of consumption, and poor quality is responsible for further expansion in the distressing total of what we have not got in efficient heat units.

Given volume of coal of the right quality, it is unbelievable that the electric utility will not furnish service as good as that with which its high reputation has been won. But the prerequisites are that coal shall be mined and that coal shall be transported to the plant. For the performance of these two duties the central station is at the mercy of private agencies in ordinary times, at the direction of government agencies in these extraordinary times. The private agencies have not demonstrated what they can do unhampered under war stress conditions, for they are not free to act except in accordance with rigid governmental regulations. As a substitute for the free play of economic forces we have set up government control over price and distribution. It is not in criticism that we point out this fact. Perhaps coal shortage would have been still more acute if all of the agencies of production and distribution involved had remained in private hands. But at the moment responsibility lies squarely at the door of the federal authorities. They have the law behind them, they have public sentiment overwhelmingly with them in any vigorous strokes necessary to speed industry. We look to them to make straight and easy the path of coal tonnage from pit mouth to boiler room. It is not selfish dependence, it is reliance upon the full force of government to provide the coal which alone can keep electric systems in operation.

Without coal service stops. It has stopped already in certain cities for some consumers. The point that is of deepest concern to central stations is to make sure that service does not stop because of anything which they do or omit to do. It is first principle with them to render uninterrupted service—not merely to keep in desultory operation but to give efficient service. They may have to discriminate between consumers because the government will require such action. They may have to withhold service at times from one manufacturer in order to give more power to another manufacturer engaged on government work. But it is clearly up to them to maintain the high standard—it will be better for them to give no service at all to parts of communities than to lower the standard.

The Oil Engine as a Prime Mover

IN THESE days of very serious coal shortage one instinctively turns to oil as a source of power. It is at the present time relatively cheap on the basis of thermal values, can be transported over long distances in pipes, and certainly makes, per thermal unit, very much lower demand on freight-hauling facilities than does coal. Moreover, it can be utilized in oil engines at a much higher efficiency than can be reached with steam engines, and hence gains still further as a practical source of power. In the current issue W. L. H. Doyle describes an interesting small plant for the electric driving of a woolen mill which was originally driven by a pair of slow-running Corliss engines operating long line shafting. As the first step toward economy in enlarging the plant this shafting was cut up into convenient lengths, each of which was motor-driven, and then a power plant was installed to take care of the electrical load. The striking part of the situation from the economic standpoint is that the plant as first installed was on a diminutive scale, with a generator capacity of only 64 kw. in a single direct-connected unit operated by a single-cylinder oil engine. This engine was arranged to operate on any reasonable sort of crude or fuel oil under a guarantee of consumption not to exceed half a pound (0.23 kg.) per brake-horsepower-hour of oil having a thermal value of 1800 B.t.u. per pound (1000 cal. per kg.).

The log sheets for the year 1916 are now fully available and show rather a remarkable result. The load factor was a scant 59 per cent and fairly constant. Including all items of expense, the cost per kilowatt-hour ran to 2.11 cents, of which nearly half belonged to the overhead charges, the oil itself being a little less than a quarter of the total. This is a remarkably satisfactory figure for so small a plant, in which the attendance was a greater item of expense than the fuel. In this instance the oil actually used was a distillate, costing 4¼ cents per gallon (1.1 cents per liter) in carload lots. More recently another three-cylinder engine of 450 hp., direct-connected to a 380-kva. generator, has been in-

stalled, with preliminary results even more promising than those just quoted. The enlargement of the plant obviously tends to keep down the labor costs as well as to raise the general efficiency through the use of larger units. At the present cost of coal fuel oil is likely to prove a very important item in power production where conditions are reasonably favorable. No small advantage is the ease with which oil can be stored and delivered to the engines. In ordinary times the high cost of the oil engines has tended to restrict their use in spite of their fuel economy. As coal rises in price the situation rapidly changes, and when one also considers the difficulties of transportation it would seem that the oil engine has a better chance than ever before. Certainly the results from this small plant are sufficiently encouraging to awaken unusual interest in the subject.

Engineering Research

THE present age of specialization is revealing its influence both in war and in peace. Military and naval officers are called upon to specialize in their duties as never before in the history of war. Indeed, the private soldiers and sailors are required to train as specialists.

Specialization either in war or in peace is the great stimulus to intensive study and research. The closer that an intelligent man becomes acquainted with a single subject, the more likely he is to feel his limitations of knowledge, and the more desirous he becomes to know more and do more. When, therefore, scientifically trained men are set to work along special lines in industry, they will, under any reasonable encouragement, tend to work out developments and improvements by scientifically directed research. National and industrial progress, therefore, depends upon the intelligence of those who enter it, as well as on their scientific training and on the encouragement of their efforts at the hands of their environing communities. If these communities despise applied science, discourage investigation and frown upon invention, the progress of industry is likely to be slow. On the contrary, when the communities appreciate scientific methods of inquiry and reward successful attempts at improvement progress is likely to be rapid.

The paper of C. E. Skinner on engineering research presented before the A. S. M. E. was a plea for the systematic study of processes and materials, as exemplified by the particular case of alloys. Enormous advances have been recently made in machining and machines through researches in alloys, yet the field of research work in that direction has only just been opened up. The more we can learn from physics and chemistry about the laws of metals and their solutions and combinations, the more likely we are to be able to predict the proper proportioning of alloys, in order to produce metallic machine parts of definitely assignable characteristics at least expense. It is well within the bounds of reasonable probability to say that if our theoretical knowledge of metals were only a little further advanced the economic value to the world of the metals and alloys thereby attainable might exceed the present total world-war debt.

It is, therefore, of the highest importance to all the nations of the world that science, both pure and applied, should be cultivated extensively in our universities, colleges, schools, factories and industrial plants. Those who show any talents or abilities for scientific investigation should be encouraged by every means to develop and then to apply them.

Engineering Students in Military Service

IT HAS so many times been remarked that this is a war of engineering that the allusion has become trite. The conduct of operations on so vast a scale as the world war displays brings engineering and applied science into continual demand. Every military officer must be to some extent trained in applied science if he is to fill his post effectively. Consequently the need for technically trained men in the army for all kinds of specialist work is very great.

But it is not merely in the front line that the engineers are needed. In the base organizations and in the rear of the fighting men technically trained officers and men are needed for a great variety of special services. Road making and repairing, machine construction, civil engineering, surveying, map making, chemical engineering, electrical engineering and sanitary engineering are but some of the occupations that an army requires right behind it.

A still larger need for technically trained men in the conduct of the war exists in the numerous factories and plants where munitions and war material have to be produced. Specialists in mechanical engineering, in structural design, in chemical production, in optical and electrical instrument making, must be kept constantly employed in the army of fighting producers behind the army of fighters in the field. It takes at least three fighting producers working hard all the time to keep one fighting man supplied at the front.

In order to cope with the demand for technical training it is vitally necessary to canvass our applied scientists and place them where the need for their services is most urgent, whether in the field or in the factory. Moreover, we must press forward the training of the students in the technical colleges as rapidly as possible. If young men are diverted from entering technical schools in sufficient numbers, there will surely be an alarming deficiency of trained men before the war has gone on many months. Time is all-important. Trained men in scientific work cannot be produced overnight. The communication addressed to the Secretary of War on this subject by the Association of American Universities will be found on another page of this number. It urges that technological students, of a certain standing in their training, should, after being drafted, be assigned to the military duty of completing their studies, in order that their capability for service to the country may be thereby correspondingly increased.

The War Department has very wisely consented to act in this matter. A new ruling has been issued by the Provost Marshal General. It was published in the ELECTRICAL WORLD for Dec. 8, 1917, page 1116. The chief of engineers is empowered to assign to the reserve corps of the engineering department, for the proper completion of their training, a suitable proportion of the students pursuing an engineering course in approved technical schools.

The effect of this ruling, if judiciously administered, will undoubtedly be to stimulate the work of the technical students of the country to earnest accomplishment. Young men who are able to reach the upper third of any good technical college are sure to be no slackers, and they can study with the assurance that they serve their country best by acquiring an engineering training.

On the other hand, it is clearly the duty of the technical colleges to co-operate with the War Department, by carrying on their training all the year round, advancing the work and diminishing the vacations, as far as effectiveness will permit.

Speeding Up Freight Handling

THERE is no more serious need just now than for hurrying up the freight service. Every commodity in every part of the country is suffering from lack of transportation. Part of this is due to the actual lack of the rolling stock necessary to take care of the volume of traffic involved. This results from lack of foresight and lack of funds on the part of the railways. The actual physical shortage in cars, too, cannot be made up quickly on account of the necessary time required for deliveries. A much larger factor in the difficulties of the situation is the proportion of cars kept inactive by the time required for loading and unloading them. By reason of bad habits of long standing freight cars by the thousand lie idle, waiting to receive their cargoes, or serve for temporary storage at the convenience of shippers. Even when there is no conscious delay on the part of anybody the actual time consumed in loading and unloading cars is often many times greater than is in the least necessary.

A brief paper in our columns this week describes the method adopted now in numerous places to facilitate this work of loading and unloading, and thereby to increase the average number of cars actually in use. The source of relief in this case is the electric industrial truck specialized for running around terminals with loads of freight, coming or going. For this service the electric truck has unique advantages. It is handled with extreme ease even by comparatively inexperienced men. It is economical in service, quick in operation and entirely free from the fire dangers which tend to discourage the use of gasoline trucks in and about buildings. The truck for this purpose is developed in the form of a tractor which picks up loaded trailers and transfers them from cars to storage or vice versa, thereby dispensing with a very large amount of manual labor and a corresponding amount of expense. It should be noted in this connection that electric power is one of the few things which have not advanced materially in price, while war conditions have greatly enhanced the wages of even the most inexperienced workers. Most of the work around terminals has customarily been done by hand trucks, slowly and at large expense. The tractors, handling loads up to about 25 tons, do the large amount of actual haulage necessary with far greater rapidity and at a much lower cost, requiring a reduced number of men for the actual work of transferring the goods from the tractor loads to the cars. In half an hour the tractor can do the same haulage that would require six men for three hours, while itself requiring the services of only two men, leaving the rest of the gang free to speed up the actual work of loading.

The result is not only a great saving of time, but economy in cost of handling to the extent of not far from 50 per cent, sometimes even more, including, of course, the cost of motive power, wear and tear, and depreciation of the tractors themselves. The larger the area covered by the terminals, and consequently the longer the hauls required in dealing with the freight, the greater the advantage of mechanical traction. But even in comparatively small freight stations the tractor "makes good" in the work of efficient and economical speeding up. Inasmuch as a very material part of the freight delays come from this local work, the improved method becomes more than ever desirable. As the war goes on labor will become scarcer and scarcer, for obvious reasons, and the advantage of mechanical traction more and more marked. The present unsatisfactory situation in freight handling has its origin in complex causes which resulted in a terrible mix-up the moment unusual demands had to be made on the transportation systems, and it is only by falling back upon labor-saving devices wherever practicable that the situation can be fairly met. Even now the gasoline truck is being tried on long hauls with considerable advantage in the saving of time and money. The electric truck has its special field in local work, and if the figures given in our article are carefully studied they will show that just here the electric truck has a wide field of practical usefulness.

The Coming Issues

IN THE next issue of the ELECTRICAL WORLD A. O. Austin will have another article on factors that should be considered in selecting insulators. He will point out the advantages and disadvantages of ground wires, the effects of operating surges on insulators and the attention that parallel circuit operations as well as local conditions should receive. Some more suggestions will be presented on how to obtain the maximum benefit from existing equipment. In addition there will appear the ninth installment of the series on industrial motor and control applications, dealing with engineering aspects of motor-driven lathes.

Industrial Trucks in Freight Congestion Relief

Use of Electrically Propelled Carriers Has Been Found to Effect a Considerable Saving in the Time of Unloading, Besides Materially Reducing the Labor Required to Perform the Work

BY F. C. MYERS, SOCIETY FOR ELECTRICAL DEVELOPMENT

WITH an excess of unfilled freight-car orders on Nov. 1 last amounting to 140,012 cars, which is 25,104 more than at the same time a year previous, and, now that winter is here, with the assurance that external conditions will be worse for some months, it is evident that strenuous methods must be employed to relieve the freight situation. Undoubtedly one of the best remedies is a quicker unloading of cars at terminals. This in turn to some extent means more efficient and time-saving methods. As a method of this kind the use of the electric industrial truck recommends itself.

It has been estimated by an engineer of considerable reputation that if one mile is added to the daily flat-car travel average it will be equivalent to 100,000 cars, which are now needed and cannot be delivered. This increase can be made by shortening the time in terminals; that is, by speeding up freight-handling methods. At the same time there will not be the necessity for added facilities for the additional cars. In this connection, of course, the industrial truck is found well qualified to produce results. Not only does the industrial truck save time and money, but it accomplishes the same work with less labor, and labor of a character no more skilled, than that employed in manual operations. This last consideration in itself is extremely important to-day.

TABLE I—COMPARISON OF PERFORMANCE OF TRACTOR OPERATIONS AT STATION IN TOWN OF 70,000 DURING AUGUST, 1917

DAY OPERATION (TWO TRACTORS), ELEVEN GANGS, FORTY TRUCKERS	
Total amount of tonnage handled, lb.	1,624,733
Average tonnage per gang, lb.	147,703
Average truckers per gang	3.6
Average number of pounds per trucker	41,029
NIGHT OPERATION (FOUR TRACTORS), FIVE GANGS, THIRTEEN TRUCKERS	
Total amount of tonnage handled, lb.	643,058
Average tonnage per gang, lb.	128,611
Average truckers per gang	2.6
Average number of pounds per trucker	49,466

Table I shows some statistics on electric industrial-truck freight moving taken from one of the most representative steam railroads operating east of the Mississippi. There are shown the saving in time and the reduced amount of labor required—both of which spell money, the money that railroads need and are begging for. Other data show some typical instances of economy in labor and time in freight handling of various commodities.

The figures show that in the day operation with eleven gangs, assisted by two tractors indiscriminately helping, the average tonnage per trucker was 41,029 lb. (about 18,600 kg.), or 20.5 tons per day. In the night operation, which was made a full tractor operation with four tractors doing all the work for five gangs and a man less per gang than in the daylight, the average tonnage per trucker was 49,466 (about 22,400 kg.), or 24.7 tons per night. From these figures it will be observed that for this day's work full tractor operation shows an increased tonnage per man of 4.2 tons over that of mixed hand and tractor operation.

The tractor in one-half hour does the work of six laborers in three hours, or in the ratio of thirty-six to one. In minor operations, such as towing large machinery on a six-wheel truck, dragging heavy cable chains into and from cars, pulling in shore gangplanks and moving large crates of 5000 lb. to 10,000 lb. (2267 km. to 4535 km.) each, the tractor did the work of twelve men. Two men were required for rollers.

The labor saving is shown by the comparative figures on labor requirements to move miscellaneous freight given in Table II.

In one instance with hand trucks on a short haul a load of 49,881 lb. (about 22,600 kg.) required twenty-four men two hours. With a truck and trailer 73,097 lb. (about 33,110 kg.) required but ten men two and one-quarter hours. On a 200-ft. (60.9-m.) longer haul 106,700 lb. (about 48,200 kg.) used the services of twenty-four men ninety-three hours with hand trucks, while with a truck and trailer 173,353 lb. (about 78,500 kg.) took only ten men sixty-two hours. With one tractor 48,876 lb. (about 22,150 kg.) can be hauled 600 ft. (182.8 m.) in twenty-five minutes, but a hand truck requires one and one-half to two hours.

In the case of freight packed up on various piers on trailers waiting for tractor, the tractor does in one-half hour what otherwise required two laborers three hours each. Only two men, a chauffeur and a conductor, are required with electric transportation.

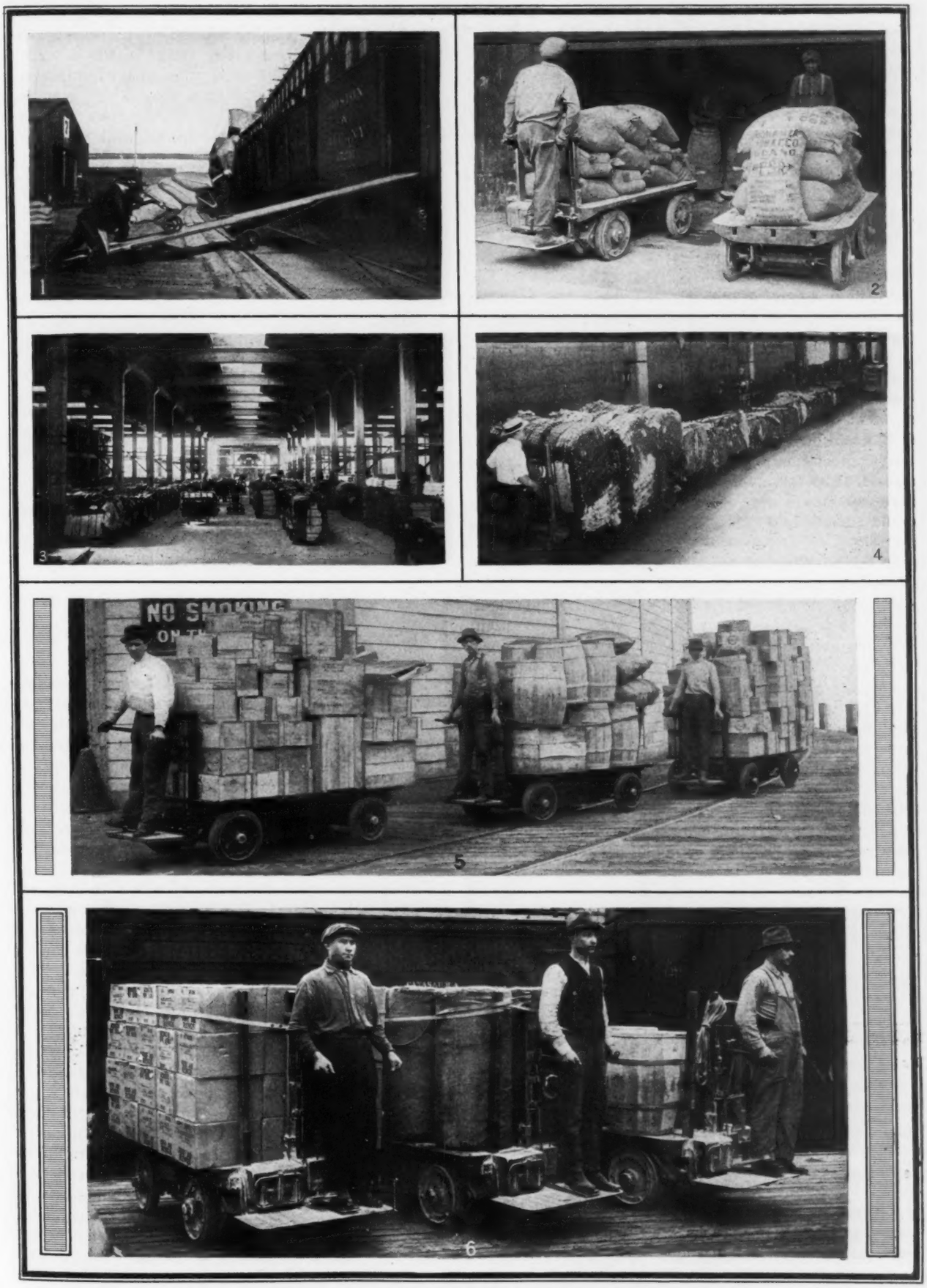
At one place of 10,000 population this railroad is using one tractor with two men to move barrels weighing 260 lb. (118 kg.) each 450 ft. (137.1 m.) from a barge to cars up the ramps. The tractor moves thirty barrels in three minutes, where formerly one man with assistance up the ramps moved one barrel in six minutes on a hand truck.

At another point the road formerly employed 132 truckers. Now it is doing this work with tractors and trailers with seventy-three men and is handling 500 tons a month more freight than formerly.

On July 16 at one transfer point there were employed 165 men; on July 17 tractors and trailers were installed and the number of men was reduced to 117, while the freight was handled more expeditiously than formerly. Since this date the tonnage has increased approximately 500 tons, and the number of men has not been increased.

The following data were taken from installations which have proved the industrial truck to be both a time-saving and labor-saving device:

In the handling of lumber 12 in. by 12 in. and 14 ft. to 20 ft. long (0.3 m. by 0.3 m. by 4.2 m. to 6 m.) fifty pieces were carried on each load, a total round-trip distance of 600 ft. (182.8 m.) with two trucks. Two



THE SOLUTION OF THE TRANSPORTATION LABOR PROBLEM

Fig. 1 shows three men with hand truck moving four bags of tobacco. At the right, in Fig. 2, one man hauls ten bags electrically. Below, in Fig. 3, one man per bale of cotton is employed with the hand truck, while the electric method of transportation in the opposite illustration (Fig. 4) uses one man for about sixteen bales. Furthermore, as shown in Figs. 5 and 6, enormous loads of boxes, bales and barrels can be hauled electrically with labor no more intelligent than is used in the manual operation.

round trips were made and required four men and took thirty minutes' time. This amounted to a total of 2000 ft. (609 m.) of board lumber, weighing about 3500 lb. to 4000 lb. (1578 kg. to 1814 kg.) per 1000 ft. Four men's time at thirty minutes, at the rate of 30 cents an hour, would be 60 cents. The charge for running this machine a full working day of ten hours is $1.25, or 6 cents for half an hour. This, added to labor cost, would be a cost of 66 cents to move 2000 board feet a total distance of 600 ft.

In another operation where lumber was handled, the size of which was 12 in. by 16 in. by 11 ft. (0.3 m. by 0.4 m. by 3.3 m.) long and the total weight 600 lb. (272.1 kg.), six pieces were carried on each load, making a total weight of 3600 lb. (1632 kg.). In one hour, two trucks and eight men moved ninety-six pieces of lumber, a total weight of 29 tons, a round-trip distance of 800 ft. (243.8 m.). The recapitulations of this show that 29 tons of lumber, or 16,900 board feet (5151 m.), were moved a distance of 12,800 ft. (3901 m.) by eight men and two industrial trucks in one hour. The labor, at the rate of 30 cents, amounted to $2.40. Wear and tear, depreciation and charge for running truck, at the rate of $1.25 for a ten-hour day, would amount to 25 cents for two hours, which, added to the above cost, would amount to $2.65. This is at the rate of 9 cents per ton.

In the handling of miscellaneous freight three electric trucks and ten men moved 53 tons a round-trip distance of 450 ft. (137.1 m.) and required five and one-half hours' time. This, at the rate of 30 cents an hour, amounts to $16.50, and, added to charges against the truck of 28 cents, amounts to $16.78, or at the rate of 32 cents a ton.

In the same operation the following was the cost of handling miscellaneous freight by hand trucks. Thirty-three tons were carried by six men with hand trucks, four men being required to load and unload, a total distance of 375 ft. (114.3 m.) in five and one-half hours' time, and this, at the rate of 30 cents an hour, amounted to $16.50 to move thirty-three tons, or a total of 50 cents per ton, showing a saving of 16 cents a ton in the use of electric trucks, which covered one and a fifth times the distance of the hand trucks.

In the handling of coffee in bags, the weight of each

TABLE II—COMPARATIVE LABOR SAVING, TRAILERS OVER HAND TRUCKS

	Lb.	Trailers	Hand Trucks, Men
40 boxes oranges	3200	3	10
102 half chests tea	7680	5	25
12 casks tobacco	2520	3	12
63 chests tea	4390	4	17
85 pig tins	8075	2	21
146 barrels groceries	3400	4	29
66 boxes oranges	5280	3	17

bag being 240 lb. (108.8 kg.), a total of 118 tons was carried on two electric trucks, which made ninety-eight trips, each 200 ft. (60.9 m.) long, and required the service of fourteen men for five hours. This, at the rate of 30 cents per hour, amounted to $21, or allowing $1.20 for wear and tear and depreciation of trucks, to $22.20 to move 118 tons, or at the rate of 18 cents a ton.

Coffee in 135-lb. (61.2-kg.) bags for distances up to 160 ft. (48.7 m.) is being handled in one place by electric trucks for 6 cents a ton. Rags in 500-lb. (226.7-kg.) bales cost up to 18 cents a ton with hand trucking. Sixty-four 800-lb. (362.8-kg.) barrels of plumbago were moved 60 ft. (18.2 m.) in twenty-five minutes for 5.3 cents per ton with electric trucks, while sixty-three

TABLE III—COMPARISON OF LABOR REQUIREMENTS, TIME OF OPERATION AND LOAD WITH HAND TRUCKS AND WITH TRACTORS AND FOUR-WHEEL TRUCKS

	Hand Trucks, Aug. 14, 1917	Tractors, Aug. 21, 1917
Trucks in line 4 p.m.	30	19
Trucks in line 4.30 p.m.	22	22
All backed up	6.19 p.m.	5.15 p.m.
All unloaded	6.30 p.m.	5.40 p.m.
Total number of packages handled	3875	5350

800-lb. barrels of plumbago were moved the same distance in two hours, costing 14 cents a ton, by hand trucking. Four men were required to guide and push the hand trucks up an incline.

One hundred and fifty 300-lb. (136-kg.) boxes of rubber were moved 75 ft. (22.8 m.) in fifty minutes for 8¼ cents per ton. By hand trucks the cost was 18 cents per ton at an Eastern terminal.

Power Transmission Through Separating Diaphragms

The invention of Benjamin Graemiger of Zurich, Switzerland, patent No. 1,233,569, relates to apparatus for driving machines by means of purely magnetic forces such that the driving and driven members are separated from each other in a gas-tight manner without the provision of a stuffing box by a partition or wall. Accordingly metal alloy of great strength and which is a very bad electrical conductor is employed for the separating partition between the driving and driven members.

The power-driven machine inclosed in a casing is driven, for instance, from the exterior without involving the use of a stuffing box by inclosing the rotor of an electromotor of any suitable construction coupled to the shaft of the machine in the casing and by separating the driving member—that is to say, the stator of the motor—in a gas-tight manner from the rotor by a wall or partition forming a part of the casing.

On the shaft driven by a prime mover is keyed the driving member, consisting of two disks between which is arranged the winding required for excitation purposes. The two disks have cylindrical polar surfaces arranged facing each other and formed with projections. The driven member is keyed on a shaft of the machine to be driven and consists of a bell-shaped disk the cylindrical portion of which extends between the two polar surfaces of the driving member and is also formed with projections on the inside and the outside. The separating partition arranged between the two members is in the form of a ring of U-section and is connected in a gas-tight manner to the parts of the casing. The action of the drive is due to the magnetic flux lines generated by the energizing winding.

Adapting 220-Volt Circuits to 110-Volt Lamps

Reduced Lamp Costs and Higher Efficiencies, Together with Other Advantages, Pointed Out as Favoring This Practice—The Lower-Voltage Lamps Constitute 85 per Cent of Factory Output

BY J. R. COLVILLE

IT IS a matter of common knowledge that incandescent lamps which are rated at 110 volts or 125 volts are more satisfactory than those designed for 220 volts or 250 volts. Lamps designed for the lower voltage range are more efficient, give a more satisfactory life performance and are lower in price than the higher-voltage units, for the reason that the higher voltages are nearer the upper limit at which it is possible to manufacture incandescent lamps that will be commercially satisfactory. Notwithstanding these facts and that there are simple expedients, such as the installation of a balancer coil or a motor-generator set, whereby most installations where 220-250 volt circuits are used for lighting can be changed over so as to use 110-125 volt lamps, there are still a great many of the higher-voltage lamps in use. It is to be assumed, therefore, that the cost in money or inconvenience is the one obstacle that has continued to stand in the way of changing these systems over. If this be true, the conclusion follows that the greater economy effected by adapting 220-250 volt circuits to lamps of the 110-125 volt class—a saving that will in general pay in a few months the cost of changing the system—is not so generally recognized as it might be.

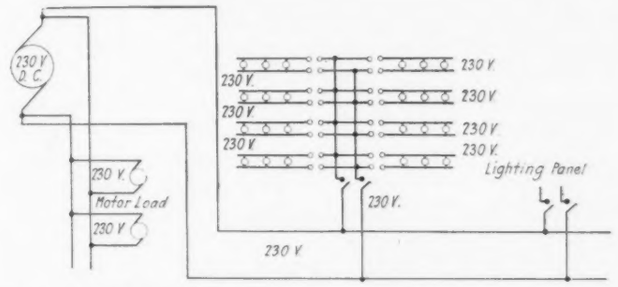


FIG. 1—UNDESIRABLE METHOD OF DISTRIBUTION OFTEN USED FOR LIGHTING IN INDUSTRIAL PLANTS

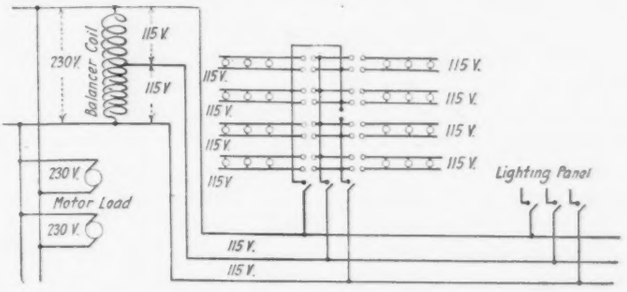


FIG. 2—ONE METHOD OF ADAPTING 230-VOLT SYSTEM TO 115-VOLT LAMPS

The difference in cost between lamps of the 110-125 volt class and those of the 220-250 volt class when purchased on different contract bases, according to schedules in force June 15, 1917, are given in Table I. It may be noted that the difference in cost ranges from about 4 cents per lamp for the smaller lamps when purchased on large contracts to as much as $1.40 when the largest lamps are purchased at list price.

Table II shows the difference in luminous output of corresponding wattages of lamps of the two voltage classes. It is seen from this table that on the average the higher-voltage lamps give only about 90 per cent of the light which corresponding sizes of the lower-voltage lamps give. Hence for equal illumination intensities more wattage is required with the 220-250 volt lamps.

In the design of new installations the number of units which may be used advantageously is sometimes closely limited by the constructional features of the building. In such cases 220-250 volt lamps of higher wattage, and frequently the purchase of more expensive reflector equipment, are required. On the other hand, if considerable latitude in the location of the units is

TABLE I—DIFFERENCE IN COST OF 110-125 VOLT AND 220-250 VOLT LAMPS WHEN LAMPS ARE PURCHASED ON CONTRACT

Based on Schedules in Effect June 15, 1917

Lamp Size in Watts	Difference in Cost on Purchase Basis of								
	List	Std. Pkg. Quantity	$150 Contract	$300 Contract	$600 Contract	$1,200 Contract	$2,500 Contract	$5,000 Contract	$10,000 Contract
Vacuum-type tungsten lamps:									
25	$0.0600	$0.0540	$0.0498	$0.0474	$0.0456	$0.0438	$0.0426	$0.0414	$0.0402
40	0.0600	0.0540	0.0498	0.0474	0.0456	0.0438	0.0426	0.0414	0.0402
60	0.0900	0.0810	0.0747	0.0711	0.0684	0.0657	0.0639	0.0621	0.0603
100	0.1500	0.1350	0.1245	0.1185	0.1140	0.1095	0.1065	0.1035	0.1005
Gas-filled-type tungsten lamps:									
200	0.2000	0.1800	0.1660	0.1580	0.1520	0.1460	0.1420	0.1380	0.1340
300	0.6000	0.5400	0.4980	0.4740	0.4560	0.4380	0.4260	0.4140	0.4020
400	0.8000	0.7200	0.6640	0.6320	0.6080	0.5840	0.5680	0.5520	0.5360
500	0.9000	0.8100	0.7470	0.7110	0.6840	0.6570	0.6390	0.6210	0.6030
750	1.2000	1.0800	0.9960	0.9480	0.9120	0.8760	0.8520	0.8280	0.8040
1000	1.4000	1.2600	1.1620	1.1060	1.0640	1.0220	0.9940	0.9660	0.9380

TABLE II—COMPARATIVE DATA ON 110-125-VOLT AND 220-250-VOLT MAZDA LAMPS

Based on Schedules in Effect June 15, 1917

Size of Lamp in Watts	Vacuum-Type Tungsten Lamps (Watts)				Gas-Filled Tungsten Lamps (Watts)						
	25	40	60	100	100	200	300	400	500	750	1000
List price, 115-volt	$0.27	$0.27	$0.36	$0.65	$1.00	$2.00	$3.00	$4.00	$4.50	$6.00	$7.00
List price, 230-volt	$0.33	$0.33	$0.45	$0.80	.....	$2.20	$3.60	$4.80	$5.40	$7.20	$8.40
Approximate cost of 230-volt in per cent of 115-volt	122	122	125	123	.....	110	120	120	120	120	120
Lumens, 115-volt	226	372	575	995	1260	2920	4850	6150	8050	12,800	18,000
Lumens, 230-volt	190	330	515	900	.....	2520	4100	5600	7400	11,500	16,100
Light of 230-volt in per cent of 115-volt	84	89	90	90	.....	86	85	91	92	90	90

afforded, a greater number of the higher-voltage lamps of a given wattage will have to be installed to obtain the same degree of illumination as might be obtained with the 110-125 volt lamps. This will mean the installation of more outlets, the purchase of a greater number of reflectors, sockets, etc., and a heavier maintenance expense. The difference in cost of lamps of the two voltages, together with the fact that fewer 110-125 volt units are required—that is, the difference in first cost of the installation—is often of sufficient magnitude in itself to pay for the installation of equipment to provide the lower voltage for the lighting circuit. The yearly saving in lamp renewals and energy is then pure profit.

A disadvantage of simply operating two low-voltage lamps in series is that failure of one means the outage of both; thus a relatively large area is left without sufficient light and the time of several persons may be lost while the defective lamp is being located and the replacement made. Obviously in industrial plants and shops accident risk under these conditions is increased over that when only one lamp is out. Furthermore, slightly less than normal life is to be expected from lamps burning in series, since one lamp naturally fails sconer than the other, and when a replacement is made the resistance of the old lamp will be higher than that of the new one. Hence the new lamp will receive slightly less than normal current and will give less than normal candlepower, while the old lamp will be forced to carry a somewhat heavier current than it would normally carry at that period of its life and will therefore fail earlier than it otherwise would. The better way of obtaining the advantages of the lower-voltage lamps is to provide 110-125-volt circuits through balancer coil, motor-generator set or other voltage-bisecting device.

Attention is called to the fact that, in addition to effecting maximum lighting economy and obtaining superior service performance, the user of 110-125 volt lamps receives the benefits resulting from the use of a more highly standardized product. Lamps of the 220-250 volt range are manufactured primarily to supply a small demand which does not justify the stocking of quantities of lamps to fill emergency requirements. Furthermore, improvements are less readily incorporated because of the greater manufacturing difficulties presented by high-voltage conditions. Lamps of the 110-125 volt class compose at present approximately 85 per cent of the output of Mazda lamp factories, exclusive of miniature lamps, as compared with a figure of less than 7 per cent in the case of 220-250 volt lamps. For this reason emergencies may be more readily met.

Some Fundamental Problems of Industrial Control

Introduction to More Specific Discussions of Machine-Tool Control Which Will Follow—Principal Functions of Controllers Outlined—Sequence of Switch Operations

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

Synopsis.—In this discussion the controller is considered as an integral part of the industrial motor. Various methods of speed adjustment are outlined in some detail and this is followed by a discussion of the practical reasons for the use of controllers. From this standpoint it is pointed out that many other functions besides speed adjustment must be performed by the modern controller. Some of the fundamental principles in the operation of the controller are touched upon and notes are added regarding elementary wiring diagrams and the graphical representation of the sequence of switch operations.

ALL motors possess inherent operating characteristics which adapt them to some extent to the changing conditions during the acceleration period or throughout a given duty cycle. Usually, however, some auxiliary assistance in the form of control apparatus is necessary to adapt the motor completely to these changing conditions, therefore the two must be considered together in determining the adaptability of any motor to any load.

In the simple direct-current shunt motor, for example, an increased load slightly retards the motor, thus reducing its counter emf., so that with a given supply voltage more current and a greater torque result with increase of load. This automatic action of the motor, although a common every-day experience with operating engineers, is sometimes lost sight of in the larger aspects of control. In other words, the motor inherently takes care of some but not all of the requirements that are imposed upon it by the load.

In other cases, while a motor might adapt itself to conditions without a controller, for example during starting, to throw the motor directly on the line might result in an acceleration rate to which the driven machinery might not be adapted. Thus auxiliary devices would be required for producing a smoother acceleration than would be possible with the motor alone. Or, again, the starting current in throwing the motor directly on the line might be so great as to cause excessive variations in the line voltage, or with large induction motors driven by a relatively small generator the heavy starting currents might result in such excessive armature reaction as to prevent starting at all.

These few considerations show, therefore, that even where various motors might be depended upon to start automatically without controllers and might even meet the requirements of some load changes by reason of their inherent characteristics, conditions outside of the motor often make the use of a controller an essential part of the equipment.

In addition to these elementary factors, which intensify the importance of control in the industrial-motor problem, many other examples might be given to show that the exacting requirements imposed by various operating duty cycles could not possibly be met without the help of controllers.

In many factory operations the part of the motor

equipment included by the term control often becomes very complex, because of the number of functions the control equipment is required to perform, these being amplified in numerous cases by the substitution of automatic control for the older forms of manual operation.

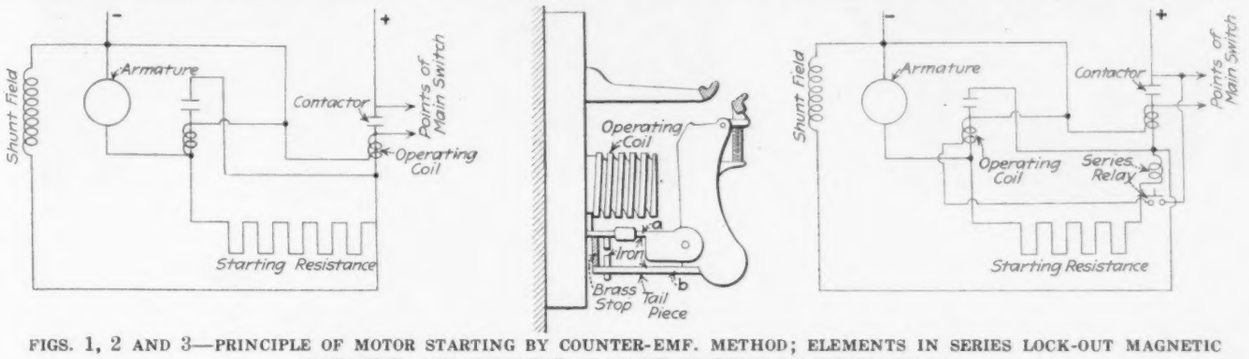
Considering, first, the control of the rotational speed of the motor, three general schemes or methods are in common use with direct-current motors, namely, (a) the use of auxiliary resistance in series with the armature whereby the emf. impressed across the armature terminals, and consequently the speed, may be adjusted, a method sometimes called armature control; (b) the use of auxiliary resistance in the shunt-field circuit of direct-current motors (for varying the field current, and hence the field flux, usually with inverse variations in the speed, that is to say, higher speeds with weakened fields and lower speeds with the higher values of the field current); and (c) the use of variations in the voltage supplied to the motor armature terminals by methods other than that of method (a).

Of these three methods of speed control, method (b) is obviously the one of chief importance since it covers the modern adjustable-speed motor which forms such a widely used unit in factory drives. Armature control is used to a considerable extent in motor starting, although variations in speed under service conditions by auxiliary armature resistance has the twofold objection that excessive heat losses are likely to occur in the armature rheostat and the speed regulation of the motor be greatly impaired. Moreover, the practice of starting small direct-current motors by throwing them directly on the supply mains eliminates the necessity of using the armature-rheostat method for starting with small motors.

Method (c) includes the older scheme of multi-voltage control, which, partly because of its greater expense and partly owing to the extra generator equipment and extra wiring it makes necessary, has been replaced generally by the use of the adjustable-speed motor. However, in certain cases, such as large hoists and for special types of steel-mill drives typified by the reversing mill, there has been an increasing tendency to use method (c), in which the variations in the voltage applied to the motor armature terminals are secured by the use of an individual motor-driven generator for the sole use of the hoist or reversing mill motor. In this manner the given generator may have its emf. varied over limits from zero to full value and also through equal limits for negative values of its emf. Since the speed of a direct-current motor (of low internal resistance) varies almost directly with the emf. impressed across its terminals, this scheme not only results in very wide speed adjustment but also makes possible very finely graduated speed increments and an effective method of reversing the direction of rotation.

For alternating-current motors of the induction type, which are also used very extensively for factory power applications, the chief scheme for obtaining speed variations is that of changing the number of poles either through the medium of a special switch in the primary circuit or by the cascade method of connections. Another scheme is to operate a polyphase slip-ring type induction motor with one phase of its secondary open-circuited. Under such conditions the motor operates over a fairly wide range of reduced speeds, and it might be used for a type of load where the torque depends largely upon the speed of driving.[1]

As pointed out before, speed control is only one of a number of functions for which controllers are employed. Some of these other functions, as outlined in the following paragraphs, constitute most important



FIGS. 1, 2 AND 3—PRINCIPLE OF MOTOR STARTING BY COUNTER-EMF. METHOD; ELEMENTS IN SERIES LOCK-OUT MAGNETIC CONTACTOR, AND PRINCIPLE OF MOTOR STARTING BY SERIES RELAY

In Fig. 1 the right contactor switch closes as soon as the main switch is thrown. Current is then supplied through the starting resistance to the motor armature. At the time of starting the drop in voltage through the starting resistance is large and the emf. across the motor armature small. The operating coil for the left-hand contactor switch is connected across the armature terminals, and as the motor speeds up its counter emf. increases, and hence a higher and higher emf. is effective across the terminals of the coil which actuate the left-hand contactor. When the emf. across the armature terminals reaches a certain value for which the controller may be adjusted, the left contactor closes and the entire starting resistance is short-circuited. In this case the starting resistance is short-circuited in one step.

The series lock-out method depends for its action on the saturation of the magnetic field (Fig. 2) due to the operating coil in the path *a* and the forcing of some magnetic flux through path *b*. As the current through the operating coil decreases, the flux through path *b* decreases and at that value for which the switch is set the tailpiece can no longer hold the contactor in its open position and the contactor closes. This switch requires no separate relay as in method *b* (see text), and it depends on the successive values of armature current during the acceleration period.

In Fig. 3 the starting resistance is short-circuited in one step. However, the closing of the second or left contactor takes place owing to the dropping of the series relay at that point when the current falls to some prescribed value, thus closing the left contactor and short-circuiting the starting resistance.

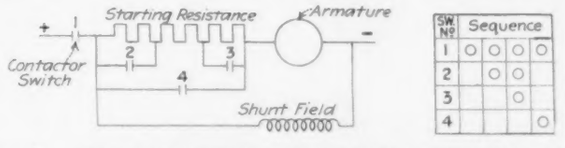
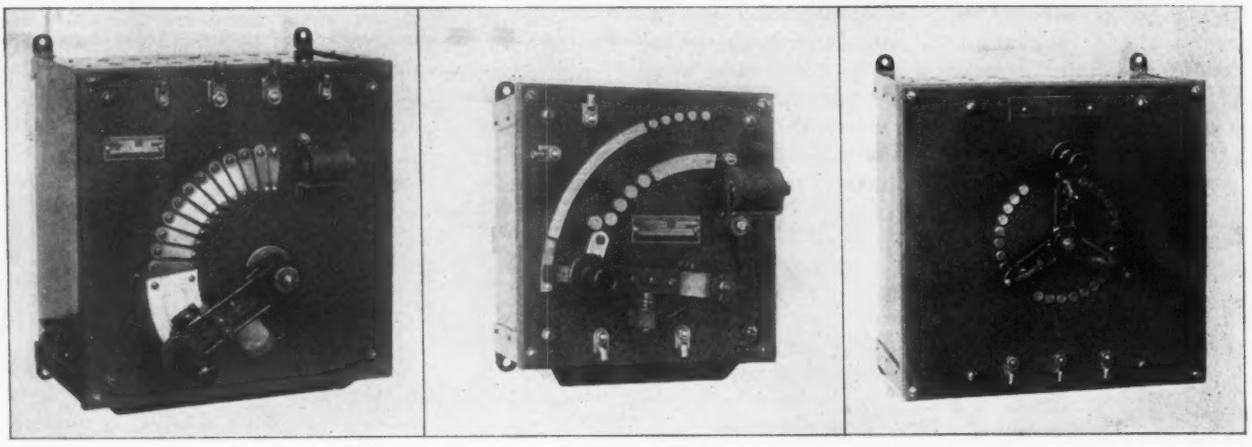
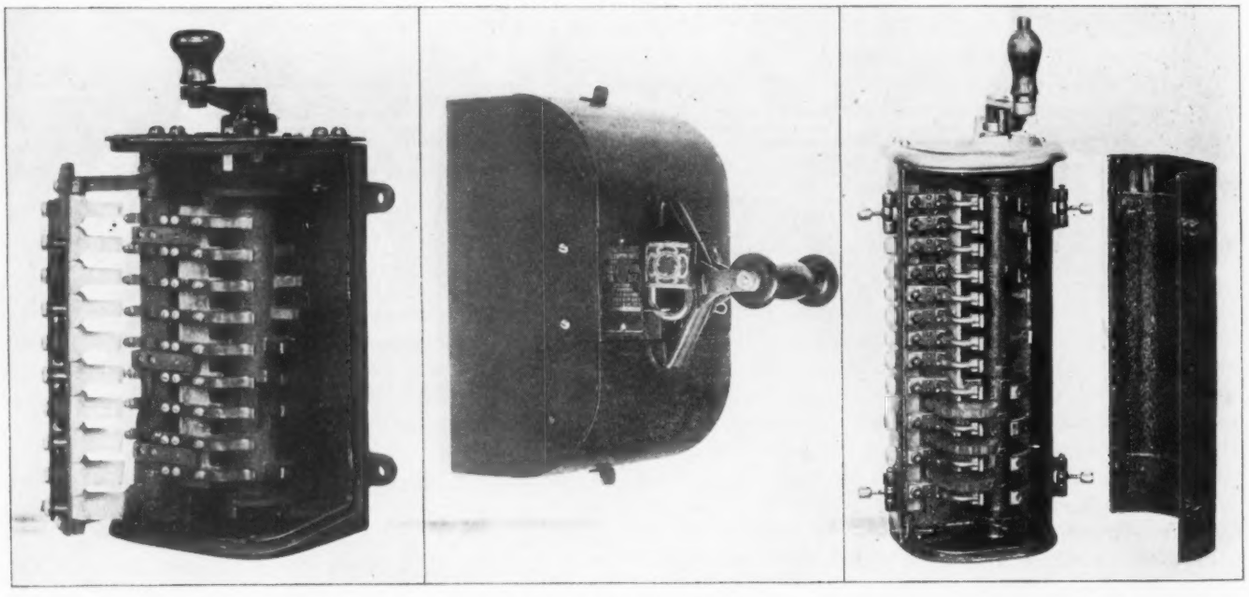


FIG. 4—SIMPLIFIED SCHEME FOR SHOWING THE MAIN CONNECTIONS OF MAGNETIC-CONTACTOR CONTROL PANELS AND SEQUENCE OF SWITCH OPERATIONS

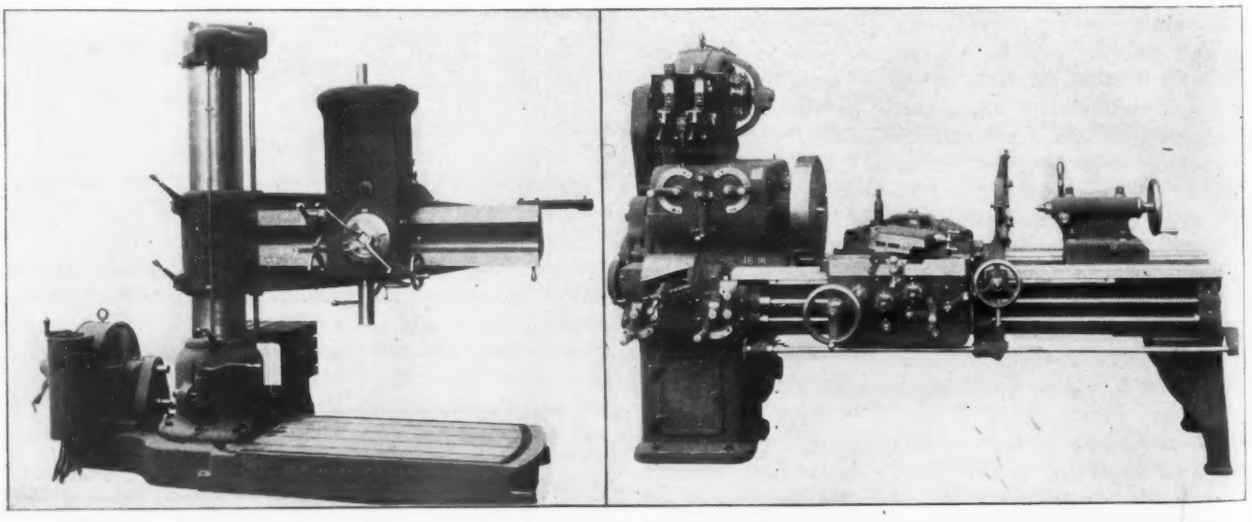
[1]See article by H. D. James, *Electric Journal*, Vol. XIV, No. 4, p. 153. In the preparation of the present article various sources of information have been consulted, notably a series of articles on industrial controllers by H. D. James in the *Electric Journal* for 1917 and data of the Westinghouse Electric & Manufacturing Company. The photographic illustrations are shown by courtesy of the General Electric Company, the Crocker-Wheeler Company and the American Tool Works Company.



FIGS. 5, 6 AND 7—HAND-STARTING RHEOSTAT (20 HP., 550 VOLTS), AND TWO SPEED-REGULATING RHEOSTATS, ONE FOR DIRECT-CURRENT MOTORS AND THE OTHER FOR INDUCTION MOTORS



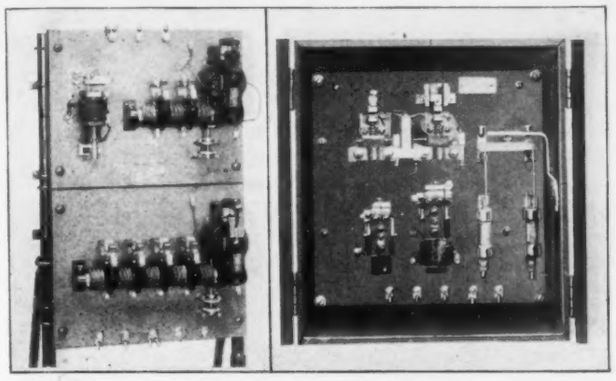
FIGS. 8, 9 AND 10—EIGHT-POINT DRUM CONTROLLER FOR POLYPHASE SLIP-RING INDUCTION MOTORS (USED FOR PRINTING PRESSES, IN STEEL MILLS, ETC.); MOTOR-STARTING SWITCH EQUIPPED WITH A LOCK AS A SAFEGUARD, AND INTERIOR OF DRUM-TYPE INDUSTRIAL CONTROLLER



FIGS. 11 AND 12—RADIAL DRILL WITH ADJUSTABLE-SPEED MOTOR AND A DRUM-TYPE CONTROLLER MOUNTED ON THE MOTOR FRAME, AND LATHE ARRANGED FOR MOTOR DRIVE WITH CONTROL HANDLES ON THE LATHE APRON AND WITH CIRCUIT BREAKER AND OVERLOAD RELEASE MOUNTED ON THE MOTOR

additions to the operating characteristics of the motor, not only contributing to its life and the protection of the load mechanically, but also forming some of the basic reasons for the economic advantages of motor drive in contrast to that by line shafting.

As indicated by the tabulated data, at least eight points may be mentioned in addition to the feature of



FIGS. 13 AND 14—PANEL FOR SELF-STARTING AUTOMATIC COMPENSATOR, AND MACHINE-TOOL PANEL FOR CONSTANT-SPEED NON-REVERSING SERVICE

speed control, all of which constitute important functions of the control equipment. Thus, from the standpoint of safety, the use of the special forms of remote control in the operation of machine tools removes entirely the necessity for the operator to come into contact with the driving mechanism. Items 2, 3, 6 and 7 are concerned partly with the protection of the motor and partly with that of the driven machinery, which might be injured by excessive mechanical strains due to unlimited torque at starting.

It is apparent, perhaps, that the points covered by items 4, 5, 8 and 9 are related very closely to the problem of efficient factory production. In fact, these four items illustrate very forcibly the important part which is filled by the controller when its design is such as to meet the conditions imposed by these items in the best possible manner.

While the control of speed is an item of fundamental importance during the period of normal operation, motor starting, or acceleration[2] from rest to normal speed, is likewise an item which calls for careful attention in controller design. With direct-current motors auxiliary resistance is placed in series with the armature and cut out or short-circuited as the motor speed increases. This may be done by hand with ordinary hand-starting rheostats like the one in Fig. 5, or with some automatic device that short-circuits the resistance in one or more steps as the motor speed increases. Several methods of accomplishing the short-circuiting automatically are now in common use, the principal ones being (a) the counter-electromotive-force method; (b) the series relay method; (c) the series lock-out switch method, and (d) the time-element method. The first three methods are illustrated in Figs. 1, 2 and 3. Method (a) is used for direct-current motors only, while method (b) may be used for either direct-current or alternating-current motors.

In the time-element method a timing device such, for example, as a dash-pot on each contactor, is employed

[2]Quite an extended discussion of the methods of accelerating motors is found in the *Electric Journal*, Vol. XIV, No. 3, p. 102.

IMPORTANT FUNCTIONS OF CONTROL EQUIPMENT

1. Provides safety for the operator by remote control.
2. Makes it possible to disconnect the motor automatically in case of the failure of the supply voltage.
3. Places a limit, by the use of fuses or circuit breakers, upon the mechanical load which can be thrown on the motor.
4. Makes possible the reversal of the direction of rotation.
5. Makes possible the speed control of the motor through any of the common methods:
   - (a) Armature resistance (direct-current).
   - (b) Field control (direct-current).
   - (c) Variations in the voltage applied to the motor armature (direct-curent).
   - (d) Changing the number of poles (alternating-current).
6. May be made to limit the current during the period of motor acceleration.
7. May also be made to limit the torque during the acceleration period.
8. Facilitates stopping the motor either by a magnetically operated mechanical brake or by the method of dynamic braking.
9. Contributes to the ease with which the motor may be started from or stopped at a given point in any duty cycle or at the so-called limit of travel in such cycles.

for introducing a retarding effect in the action of the contactors producing smoother acceleration if set properly.

SEQUENCE OF SWITCH OPERATIONS

It is very convenient in studying controller diagrams to employ a simplified diagram of the main connections in conjunction with a tabulation of the switch positions during the acceleration of the motor. For example, the table in Fig. 4 indicates that at first contactor 1 is closed, next contactors 1 and 2 are in the closed position, then contactors 1, 2 and 3, and finally 1 and 4. By referring to the main connection diagram

FIG. 15—STARTING COMPENSATOR WITH RELAYS FOR AUTOMATICALLY OPENING CIRCUIT ON OVERLOAD, INTERRUPTION OF SERVICE, ETC.

it is a simple matter to see the exact conditions of the circuit for each of the four settings of the contactors indicated in the table.

These notes have given a general outline of the fundamentals of the controller problem and will serve as an introduction to the more specific discussion of given machine-tool drives in subsequent articles.

Providing the Power for Increased Production

How a Textile Mill Has Taken Care of Larger Output by Converting from Mechanical Drive to Electric Drive, Using Oil-Engine-Driven Generators

BY W. L. H. DOYLE

WHEN the Thomas Oakes Company, Bloomfield, N. J., had to enlarge its factory facilities to care for the increased demand for woolen fabrics such as are used in uniforms it was confronted with the problem of providing more power to drive the machinery. As is typical of mills of this kind, all the woolen card looms and various other machines were at that time driven by belts from parallel rows of line shafting extending lengthwise of the various buildings. The shafting in turn was driven by two 18-in. and 30-in. by 36-in. (45.7-cm. and 76.2-cm. by 91.1-cm.) cross-compound Corliss steam engines, each engine being installed as nearly as possible central as to its load.

After a careful study of conditions it was decided to change to electric drive and cut the great lengths of shafting up into individual motor-driven sections. Each section was arranged to care for ten to twenty looms or threading machines, depending on the size, while each wool-cleaning and carding machine was equipped with its own separate motor. These motors are all 240-volt, three-phase, 60-cycle induction machines with ratings ranging from 5 hp. to 15 hp. each.

The next problem was to decide on the source of power. The merits of central station service, steam-engine-driven and oil-engine-driven generators were carefully investigated. While the initial cost of the last was the highest of the three, yet when all the factors that go to make up the resultant average yearly unit

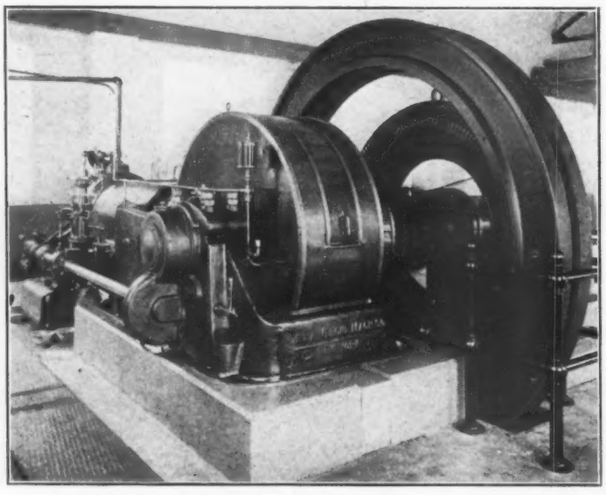


FIG. 1—CRUDE-OIL ENGINE INSTALLED IN TEXTILE MILL TO PROVIDE ELECTRICITY FOR INCREASED PRODUCTION

power cost were taken into consideration, it was decided by the Oakes company that the last mentioned source of power would be the most desirable. Accordingly a single-cylinder De La Vergne Type FH oil engine, operating at 200 r. p. m. and directly connected to a 64-kw., 0.8-power-factor, 240-volt, three-phase, 60-cycle alternator with a belted exciter, was installed.

The complete unit as finally erected is shown in Figs. 1 and 2. The engine is of the horizontal, four-cycle, medium-compression type and is guaranteed to operate on any grade of commercial crude or fuel oil containing less than 1 per cent water, irrespective of its actual

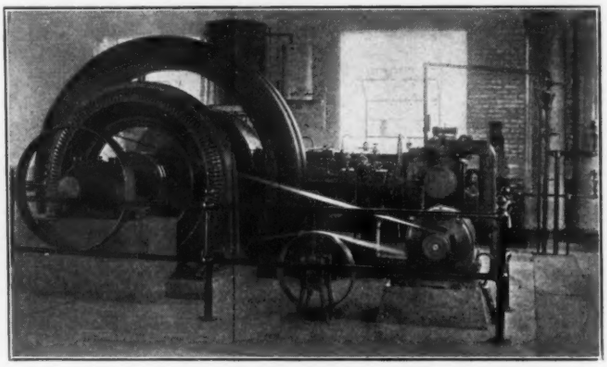


FIG. 2—GENERATOR BELT CONNECTED TO EXCITER; AIR INTERCOOLERS IN BACKGROUND

asphaltum or sulphur content. Fuel consumption, based on an oil having a heat content of 18,000 B. t. u. per pound, was guaranteed not to exceed 0.5 lb. (0.22 kg.) per brake-hp.-hour, or 0.74 lb. (0.33 kg.) per kilowatt-hour at the switchboard.

The piston is of the trunk type and has a cone-shaped head instead of the more usual flat head. The fuel is injected across the end of the cylinder into an uncooled vaporizer chamber. To facilitate injection of the oil and to insure the greatest possible atomization, air at from 800-lb. to 900-lb. pressure (56.2 kg. to 63.3 kg. per cm.) is used. This pressure is developed in a two-stage tandem single-acting air compressor driven by an eccentric on the crankshaft. The cylinder liner is removable, the head end being held rigidly in place by the cylinder head, while the crank-case end passes through a water-tight expansion joint in the main frame. The cylinder head is so designed that the valves act vertically, all valves being contained in individual and quickly removable cages.

Mounted on the foundation pedestal near the governor bracket is a small plunger pump which lifts the fuel oil from a 10,000-gal. (37,850-l.) storage tank buried in the ground just outside the engine room to a small standpipe. From here it flows by gravity to the engine pump mounted on the governor bracket. Both pumps are operated by cams on the camshaft. The oil by-passed by the governor overflow valve is returned to the standpipe. A constant level is maintained in the standpipe, and any excess oil is returned through a separate pipe to the storage tank.

A sight-feed pressure oiler supplies lubrication to the motor and low-pressure compressor pistons, the oil being fed in at the top through a quill to a point near the center of the piston travel. All other bearings are sup-

plied with oil under gravity head from a storage tank mounted on the wall. Oil for the crank and wrist-pin bearings drops into a collector ring on the crankshaft and is fed to the center of the crank pin and from there through the center of the connecting rod to the wrist-pin bearing.

All the oil from the various bearings eventually finds its way into a drip tank under the engine. From here it is lifted by air under pressure to a clarifier shown mounted on the wall near the center of Fig. 2. This is a Type "B" oil reclaimer and was especially designed to remove the impurities and fine carbon precipitate which occur in the drip oil. With this apparatus installed the lubricating oil consumption is guaranteed not to exceed 0.5 gal. (1.89 l.) per 1000 brake-hp.-hour.

To the right in Fig. 2 will be seen two large air tanks. These are used both as intercoolers between the low-pressure and high-pressure stages of the compressor and as the source of air supply when starting the engine. A constant pressure of 100 lb. (7.03 kg. per sq. cm.) gage is maintained in these tanks, this being ample for starting purposes.

The water for cooling the engine is drawn from a nearby mill pond. It enters the jacket with an average temperature of from 60 to 70 deg. Fahr. (15.6 to 21.1 deg. C.) and leaves at a temperature of 160 deg. Fahr. (71.1 deg. C.). From here it flows through a heater in the exhaust line of the engine, where it attains an approximate temperature of 200 deg. Fahr. (93.3 deg. C.) and is then delivered to the dye house.

The log sheets for the year 1916 show that the total output of this unit as delivered at the board was 167,340 kw.-hr. This makes the load factor 0.58, based on the total number of working hours. Despite this rather poor load factor, the cost of power for the year was remarkably low, as will be noted from the following data taken from the yearly report:

	Annual Expense per Kw.-hr.
Attendance	$0.00528
Supplies	0.00115
Repairs	0.00083
Fuel oil	0.00444
Overhead charges, consisting of interest, taxes, depreciation and insurance	0.00940
Total	$0.02110

In this connection it may be pointed out that the load during the month of December, 1916, averaged 54.5 kw., ranging from 49.2 kw. (minimum) to 59 kw. (maximum). Except on Saturdays, when the mill operates five and one-half hours a day, the generators are operated ten hours a day. The load is fairly constant. For fuel distillate oil is used which costs 4¼ cents per gal. (1.10 cents per litre), delivered in carload lots.

The very satisfactory performance of the first unit led to the subsequent installation of a three-cylinder engine of the same make shown in Fig. 3. This is a 450-hp. type FH engine running at a speed of 164 r.p.m., and is direct-connected to a 380-kva. alternator of the same characteristics as the former unit. A 25-kw., belt-driven generator delivering energy at 110 volts is used to excite the field of the alternator.

This engine is of rather unusual and unique design. The cylinder jacket, as is usual in the larger-powered present-day oil engines, is cast integral with the main frame, but the latter has an interlocking construction which permits the annexation of other cylinders. By this means horizontal engines of three and four cylinders can readily be built. This makes a very compact powerful unit which occupies a minimum amount of floor space. The new unit is controlled by a fly-ball governor which regulates the timing of the oil-pump suction valves, there being one pump for each cylinder. In the case of the small unit the governor controls the

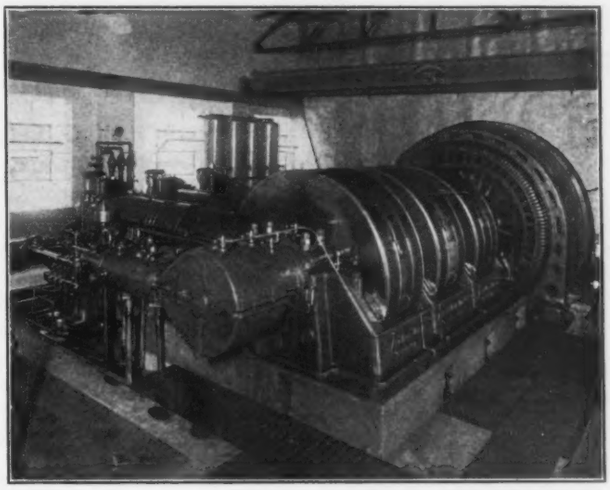


FIG. 3—THREE OIL ENGINES WITH INTERLOCKING BASES AND ONE CRANKSHAFT

quantity of oil delivered to the spray valve by acting on a by-pass valve in the fuel-oil pipe leading from the pump. Normally each machine carries a separate load, but the speed regulation of the two units is so close that no difficulty is experienced in operating the two units in parallel long enough to shift the load from one to the other when occasion demands.

The last unit referred to in the foregoing has only been in operation a short time, but the log sheets indicate that it will show an even lower power cost than the single cylinder unit. The over-all efficiency of a plant of this kind is about 30 per cent, or from 20 to 25 per cent better than the typical steam-driven plant of the same size. This difference means a big saving in fuel cost alone, and now that coal is so high the owners are congratulating themselves on having installed this more economical type of prime mover.

France Promoting Hydroelectric Development

Questions relating to the utilization of the power of non-navigable rivers and streams in France have been transferred for the period of the war from the Ministry of Agriculture to the Ministry of Munitions, according to the London *Electrical Review*. The Minister of Agriculture has stated to the French Parliament that plants rated at 400,000 hp. have been established or are in course of construction in the Alps, the Pyrenees and central France. He also said that the generating stations were under agreement to supply for a number of years after the war a certain proportion of the energy generated at a cheap rate. Several of the plants in question were in connection with factories making explosives with a calcium carbide base. With the cessation of hostilities, it would not be difficult to convert such plants to cyanamide manufacture, which would be of great benefit to French agriculture.

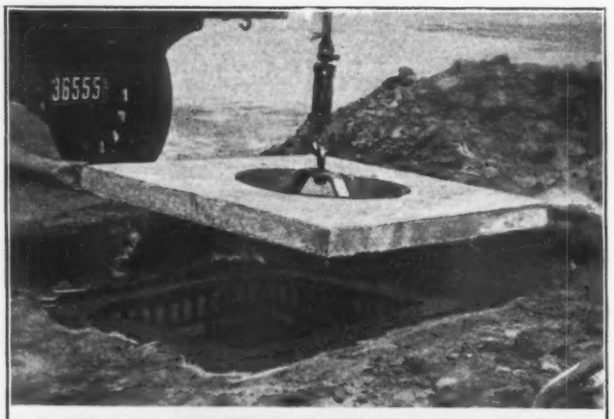
STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MONEY-SAVING METHOD IN MANHOLE CONSTRUCTION

Use of Previously Molded Reinforced-Concrete Slabs Made in a Standard Size Makes a Better Job at a Smaller Cost

Considerable expense in manhole construction is being saved on the boulevard lighting system at Lincoln Park, Chicago, by using an already-molded reinforced-concrete slab on top of each manhole instead of drawing in the brick walls from a square to a circular plan to fit the cast-iron cover frame. The slabs, which measure 52 in. by 52 in. by 3 in. (132 cm. by 132 cm. by 7.6 cm.), are easily handled by means of a small jib crane attached to the rear platform of a 5-ton



FIGS. 1 AND 2—LOWERING THE SLAB FROM THE PLATFORM OF THE TRUCK BY MEANS OF A JIB CRANE, AND THE CAST-IRON COVER SET OVER THE HOLE IN THE SLAB

(4.53-t.) electric truck. When the slab and the frame are in place earth is shoveled over the slab and sod is laid flush with the 24-in. (60.69-cm.) cover.

Slabs of the size mentioned are used on manholes of all sizes between 2 ft. (60.9 cm.) square and 4 ft. (121 cm.) square. This practice permits the slabs for all but special jobs to be bought in quantities, with the result that it has been possible to get the standard size for $3 per slab. The average cost of setting a slab is about $1. At a total cost of $4 the slab construction is much cheaper than brick, chiefly on account of the extra labor required in building the rounded neck of the hole. Moreover, the slab construction, according to C. H. Shepard, electrical engineer for the Lincoln Park Commissioners, is better than brick, because the slabs may be used easily again and again if it becomes necessary to change or to move the manholes, whereas the use of old bricks in reconstruction is of doubtful economic value when the loss of cleaning them in small quantities is considered.

FUEL ECONOMY SUGGESTIONS FOR EMPLOYEES OF PLANTS

To Effect a Saving in Furnace Expense Requires, as Does War, United Effort and Determination on the Part of Those Involved

Following are ten suggestions* for saving fuel. They were published in a recent issue of the *Doherty Daily News* and should prove of practical helpfulness to other plants:

1. Watch conditions in the boiler room, as that is usually the place where the biggest opportunities to make fuel savings occur.
2. Keep the boilers in fit condition by thorough systematic inspection, cleaning and repairing. A boiler should never be put back in the line after being down for cleaning or repairs until it has been completely inspected and all of the defects have been remedied. The inspection should be thorough and rigid and should cover not only the internal and external surfaces of the boiler, but the baffles, settings, piping, valves and all appurtenances.
3. Blow the soot from the tubes daily.
4. Keep the hand-fired grates or automatic stokers in a good state of repair or they cannot be operated very economically and may become extremely wasteful. Thorough inspection and repairs are absolutely necessary if economical stoker operation is to be obtained.
5. Assist the fireman to get proper combustion and boiler operation by (a) analyzing the flue gases, (b) determining the percentage of combustible in the ash, and (c) analyzing the fuel.
6. Study the drafts and flue temperatures in the boilers and see that the baffles, bridge wall, dampers, etc., are properly maintained.
7. Keep no more boilers "hot" than are absolutely necessary to carry the load during the peak, and make sure that the most efficient method of banking is being used during off-peak periods.
8. Keep the steam leaks about the plant down to a minimum and give special attention to small steam valves to keep them tight. See also that the steam traps and drip system are in proper condition.
9. Make sure that the exhaust steam from the auxiliaries is being used to heat the feed water in the most efficient manner. See (a) that there is no free exhaust not going to the heater, (b) that there is no steam exhaust from the heater with a water temperature of less than 210 deg. Fahr. (100 deg. C.), (c) that there is not an unnecessary amount of hot water overflow from the heater (if so investigate thoroughly), and (d) that the oil separator is properly piped up.
10. Do not overlook plant cleanliness.

*It was pointed out that if every Doherty power plant could save 10 per cent of its fuel through more efficient methods the coal saving to the country would be approximately 7500 tons a month.

MAXIMUM EFFICIENCY IN BURNING FUEL OIL

Method of Limiting Steam Used for Atomization—Regulation of Air Supply and Proper Arrangement of Checkerwork

BY FRANK W. SMALL
Electric Generating Department Pacific Gas & Electric Company

Several factors determine the successful burning of oil, some affecting the reliability of the system and others its efficient operation. Those reducing the reliability of the system have been overcome so that at present oil-burning apparatus is as reliable as any other part of an electric service plant. The factors affecting the efficiency of operation vary a great deal, every large oil-burning plant having various innovations for obtaining the most economical results throughout a wide range of operating conditions. Some of those found in a large oil-burning installation on the Pacific Coast are described briefly in the following paragraphs.

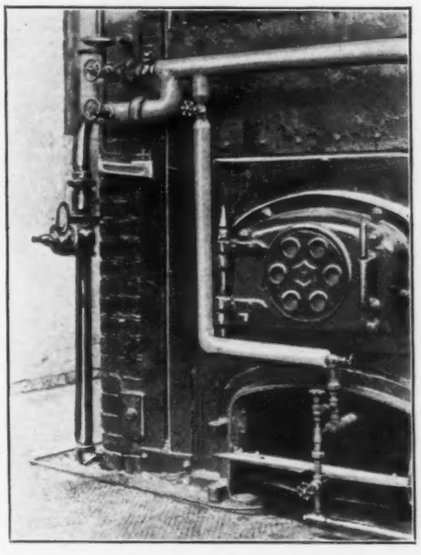


FIG. 1—VALVES AND PIPE CARRYING STEAM FOR ATOMIZING OIL

The plant under consideration operates in parallel with a hydroelectric system, and owing to the varying demands upon the station it is necessary to operate the boilers anywhere from 33⅓ per cent to 180 per cent of rating. At first, in attempting to atomize the oil thoroughly, the firemen very often used much more steam than was necessary. In fact, by test it was found that what appeared to the fireman as the proper amount of steam for atomization was in reality in the neighborhood of 5 per cent of the total steam generated instead of being between 1 per cent and 2 per cent. To limit the amount of steam used for this purpose the arrangement shown in Fig. 1 was devised. The flanges in the upper of the two parallel-pipe sections have a steel disk inserted between them, this disk having a small hole, from 5/16 in. to 7/16 in. (0.8 cm. to 1.12 cm.), depending on the size of the boiler, drilled through it. When the boiler is running at rating all the steam for atomizing passes through this hole, the lower valve on the by-pass around the disk being closed. When it is necessary to carry a heavy load on the boiler the lower or by-pass valve is opened and enough steam can be obtained for any overload desired. The valves having rising stems, it is possible to tell at a glance whether the by-pass is open or closed. By this method of operating the steam for atomization is restricted to about 1 per cent when operating at rating.

The principal consideration affecting the efficiency of an oil-burning installation, other than the choice of an oil burner which is economical in the use of steam and gives the proper shape of flame, is the proper control of the air supply. One of the advantages of burning oil is the possibility of reducing the excess air, and, conversely, one of the principal losses is the ease with which excess air can be admitted. For any particular installation, assuming that the setting is tight and the checkerwork properly arranged, the best draft should be determined by means of a differential draft gage connected to the furnace and to the top of the last pass of the boiler. At the same time analyses of the escaping gases should be taken to assure proper supply of air.

To regulate the draft in this plant a damper rod extends to the front of the boiler, as shown in Fig. 1, and is arranged so that the damper can be opened or closed in very small increments. For the benefit of the fireman the damper lever is marked in three places which indicate the position in which the damper should be when operating one, two or three fires. The swinging doors in the ash-pit openings are also adjustable and are used to obtain closer draft regulation at light loads.

The checkerwork under each burner, which is arranged as shown in Fig. 2, is made to conform to the shape of the flame. The openings are so proportioned that the total free area shall never be more than 3 sq. in. (19.3 sq. cm.) per rated boiler-horsepower, as it has been found that this ratio is sufficient to allow the boiler to be operated at 200 per cent of rating. Between each group of checkerwork is a dividing wall extending from the bottom of the ash pit to the floor of the furnace and from the front wall to the bridge wall. The chief advantage of this arrangement is that when any burner is not in service and the ash-pit door in front of it is closed the air entering through the other doors cannot enter the furnace through the checkerwork in front of the burner which is "out."

Each oil burner is set in a recess in the bridge wall so that any air entering around the burner will be drawn into the furnace by the inspirating action of the burner. The height of the burner above the checkerwork received attention, and after various experiments it was found that a height of from 4½ in. to 6½ in. (11.4 cm. to 16.5 cm.) above the checkerwork gives the best results. It was thought at first that the amount of soot and ash deposited on the tubes of a boiler burning oil as fuel could be blown off with a hand steam lance, but it was found that in large-sized boilers this method was not effective, and it is now the practice to equip the boilers with mechanical soot blowers.

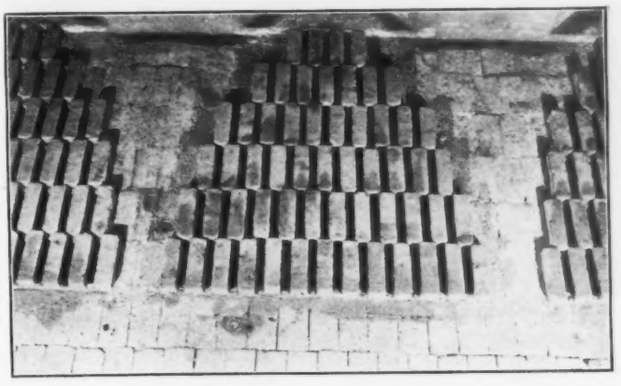


FIG. 2—ARRANGEMENT OF BRICK CHECKERWORK

TAPPING A 13,200-VOLT THREE-CONDUCTOR CABLE

Specifications for Making Straight Joints Followed Except for Details Outlined—Method Used by the New Jersey Company

BY E. B. MEYER

Assistant to Chief Engineer Public Service Electric Company, Newark, N. J.

When it is necessary to make branch and Y joints on three-conductor, 13,200-volt cables the method described below, which has beeen found satisfactory in practice, may be used.

The specifications for making a straight joint are followed, except that a 6-in. by 28-in. (15.2-cm. by 71.1-cm.) sleeve is used instead of a 4-in. by 20-in. (10-cm. by 50.8-cm.) sleeve. A copper connector of a sufficient size to accommodate two conductors laid side by side is employed. The ends of the through cable are cleaned in the same manner as usual. After the end of the tap is cleaned in a similar way it is bent slightly and laid parallel to one of the through cables, which have been butted together. A connector somewhat larger than the conductors is spread over them and all are sweated together. Then each leg is insulated in the usual manner, and in addition the tape is threaded through the Y-shaped branch formed by the tap and conductors. In belling the end of the lead sleeve at the double end it will be found necessary to cut away a portion of the lead to conform to the shape of the two cables leading into the splice. A small piece of sheet lead may be required to form a backing for the lead between the cables. Filling of the joint is done in the usual manner.

RECORDING VOLTMETERS ARE USEFUL AT FEEDER CENTERS

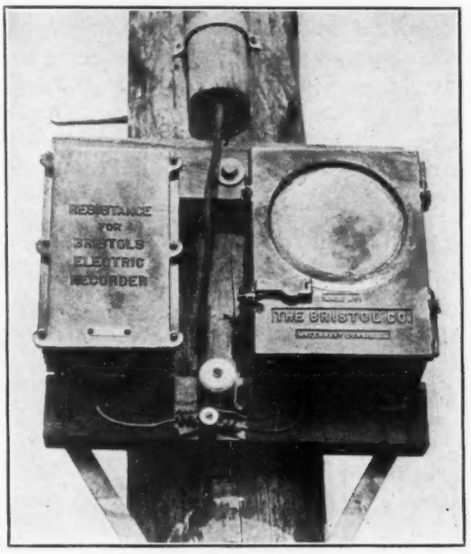
Used to Keep Check on Service Rendered—Avoid Error Caused by Depending on Station Instruments with Line-Drop Compensators

Complaints may be divided into two classes, those that are justified and those that are not. It should be the endeavor of every central station to prevent or correct the first class and to have at hand evidence to disprove the latter, especially before regulatory bodies.

Poor service from the lighting customer's standpoint usually means abnormal voltage, fluctuating voltage or no voltage. Although voltmeters equipped with line-drop compensators may be employed at station or substation switchboards to indicate the primary voltage at the feeder center, shifting load centers and power-factor conditions on each feeder tend to cause errors in the readings. Even if readings are noted at half-hourly intervals, momentary fluctuations are ignored, and the result is not so clear and permanent a record as the continuous chart.

For these reasons and in order to perfect its service and to keep a record of the quality of service rendered, one company has found it desirable to place a seven-day recording voltmeter at the load center of each of its lighting feeders. While a curve-drawing meter at such positions affords no indication of the individuals who suffer from inadequate transformer or secondary installations, nevertheless it constitutes an excellent index to the quality of service rendered the great bulk of customers. It also aids considerably in the proper setting of contact-making voltmeters on the regulators.

From the illustration it may be noted that the meter and resistance used are of the weatherproof type. In overhead districts the instruments are mounted directly on the pole on short crossarms, low enough to be reached by a man with a stool or short ladder. Ordinary distribution-type transformers rated at 0.6 kw. or 1 kw. are used in conjunction with the meters, the voltage ratios being checked against standards before



DETERMINING VOLTAGE FLUCTUATIONS AT FEEDING CENTER

installation. The vertical leads to the meter are covered with a wood molding. In underground districts meters are installed in private transformer vaults, where available, rather than in manholes. The meters are wound and checked with a portable standard at weekly intervals.

PULLING IN LEAD-SHEATH CABLE WITH A TRUCK

Operations of an Iowa Company Give Proof that Lead-Covered Cable Can Be Pulled at Speeds Higher than Those Attained by Winches

The Iowa Railway & Light Company of Cedar Rapids recently pulled in 2800 ft. (853.4 m.) of 2300-volt, 600,000-circ. mil. two-conductor, concentric, varnished-cambric, lead-sheath cable with a truck without interposing a winch in the pulling-in line. An ordinary wire cable grip was used. The manholes were each fitted with pulling irons. Sheaves were used to guide the cable into the hole and prevent damage to the sheath. When a pull was made the truck was operated in reverse to get more power and less speed. It was necessary to put a 25-kva. and a 37.5-kva. transformer on the truck to keep the wheels on the ground.

The longest single pull measured 440 ft. (134.1 m.). This length of cable was pulled in just eight minutes, which was as slow as the truck could be successfully operated. Ordinarily it requires twenty-five minutes to make a pull of this length with a winch, even though it be power-driven. The engineers of the company, while firm in the belief that the cable was unhurt, think the speed too great for general recommendation.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

VALUE OF PUBLICITY OF A DISTINCTIVE CHARACTER

Wholesomeness of Effect of Quality Advertising Material as Exemplified by the Work of the New York Edison Company

Publicity of a distinctive character designed to appeal to the finer instincts of the reader is generally recognized as the best in the long run. Its first appearance might not be so fruitful of results as something more spectacular. The lasting results, however, and the wholesome effect made on the reader are rather the angles from which publicity, especially that put out by an electric lighting utility, should be viewed.

One of the best examples of this kind of advertising matter is that issued by the New York Edison Com-

LITERATURE THAT GETS THE PUBLIC'S ATTENTION

pany. Throughout the territory served the New York Edison "colonial men" are known and recognized as standing for a certain service.

Besides, all of the circulars and catalogs distributed by the company have a quality appearance. The workmanship is perfect in its simplicity. No attempts are made to burden the reader with a mass of descriptive detail, but only a few of those sales facts for which the customer first asks are printed. The effect on the reader, therefore, is one of sympathy toward the utility.

While it is true that most other utilities may not be able to afford a service of such quality, it is certain that much could be done to improve the character of the advertising material now distributed. It is well known that central station managers as a rule give much less thought and attention to their publicity efforts than they should. In fact, a utility by its very nature is more affected by impressions made on the public than are most other businesses, and consequently it has more reason for taking great pains with its publicity.

MODIFY EXTENSION RULES TO CONSERVE THE CAPITAL

Chicago Companies Petition Commission to Suspend Provisions Relating to Free Line Extensions Under the Prevailing War Conditions

The Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois have petitioned the Illinois Public Utilities Commission to suspend during the war provisions of the rule covering electric service line extensions. The petition points out that the cost of copper wire and other materials, as well as of labor, has advanced abnormally, and that the necessity of conserving capital resources is of even greater importance in the present emergency. It says:

Owing to war conditions the cost of copper wire and other supplies and materials and of labor entering into the making of electric line extensions has advanced in an abnormal degree, and petitioner therefore has found the provisions of said Rule 31 to be unreasonably and unjustly burdensome. While the actual cost of petitioner of making electric line extensions in the territory served by petitioner has vastly increased as aforesaid, the average annual income per customer has not increased, with the result that the cost of making such an extension, which cost at the time of the adoption of said Rule 31 bore a fair and proper relation to the average annual return or income to be derived therefrom, has now increased to an extent which is out of all proportion to such return or income.

Furthermore, and of even greater importance than the excessive advance in the cost to petitioner of materials and labor, there is the fact that the country, while it is in the grip of war, is confronted with the necessity of rigidly economizing and conserving its resources, not only materials and labor such as enter into line extensions of this character, but capital. In view of this need of conserving the capital of the country for the prosecution of the war, as well as because of the scarcity of capital and the prevailing excessively high rates of interest on money borrowed, petitioner believes that during the period of the war it should be relieved, except in emergency cases, from making any capital expenditures for line extensions; that no line extensions whatever should be made except where absolutely necessary; and that where such an extension appears to be absolutely necessary the cost of such extension should in the first instance be advanced by the applicant for service.

THE ILLUMINATION OF AN ATHLETICS FIELD

Natural Amphitheater, 450 Ft. by 270 Ft. in Size, Lighted to Average Intensity of 1.5 Ft.-Candle with Angle Reflectors

BY F. H. MURPHY
Illuminating Engineer Portland Railway, Light & Power Company

Multnomah Field, belonging to the Multnomah Amateur Athletic Club of Portland, Ore., is situated in a natural amphitheatre and is admirably located for the staging of outdoor evening entertainments. However, until recently it lacked proper lighting facilities for making this possible. A feeble attempt had been made to furnish some light by suspending two steel cables across the center portion of the field about 60 ft. (18.2 m.) apart and about 35 ft. (10.6 m.) above the ground. From each of these cables were hung four carbon arc lamps. The result was a poor and uncertain light immediately underneath the lamps, while at either end of the field virtual darkness existed and the glare of the arcs was continually within the range of vision. It was, in fact, unsatisfactory for any purpose.

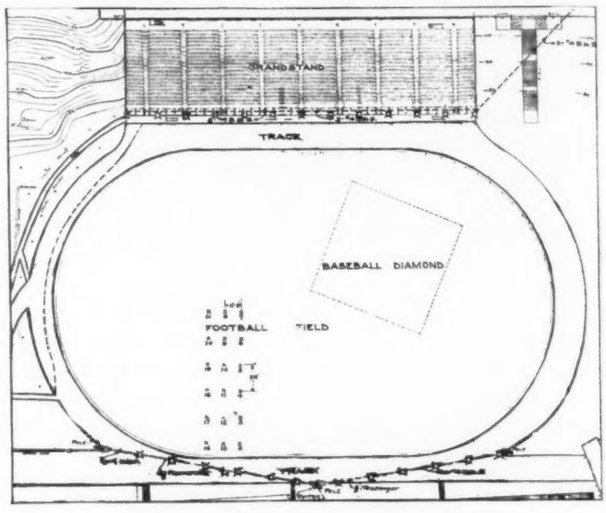
At the beginning of the present summer it was decided to stage a "Western Round-Up," giving both afternoon and evening exhibitions. This necessitated relatively uniform illumination over the entire field, as there was no way of foretelling in what part of the grounds an exciting event might be staged, and there must be sufficient light to see clearly what was taking place everywhere.

Because the field is used at times for football and baseball games, overhead cables of any nature were prohibited; furthermore, the funds available for the installation were somewhat limited. The problem, therefore, resolved itself into one of lighting the field from the sides. The area to be lighted was approximately 450 ft. long by 270 ft. wide (137.1 m. by 82.2 m.). An average illumination of 1.5 ft.-candles was considered

ILLUMINATION OF SPORTING FIELD IN PORTLAND, ORE.

the minimum that could be satisfactorily used, with considerably higher intensities where special events were to be staged, such as fancy roping, etc. Assuming that the reflectors to be used would under the conditions have a utilization coefficient of 40 per cent, it would require twenty-six 1000-watt units to give the desired illumination. Floodlighting units were at first considered, but these were soon eliminated because of their cost, and the installation was made with B. E. L.-1000 Ivanhoe angle reflectors. The total cost of the installation was $612, which represented approximately $23.55 per unit.

Along the grand-stand side of the field the units were mounted just underneath the edge of the roof. On the



PLAN OF THE FIELD ILLUMINATED

opposite side of the field three poles were erected and the units were mounted on a ⅝-in. (1.6-cm.) messenger cable supported by the poles. The units are all maintained at a uniform height of approximately 45 ft. (13.7 m.) above the field and are spaced about 25 ft. (7.6 m.) apart along either side.

About two months after the installation was completed an illumination test was made at the stations shown on the map. This particular strip was taken as representing an average condition of the field. A Sharpe-Millar portable photometer was used and the test was made upon a 36-in. (0.9 m.) plane. Three readings were taken at each station. The values given in the table represent the average of the readings. They have also been corrected for the screen used in some of the lower readings. The average illumination as shown by these readings is 1.55 ft.-candles, which is probably approximately correct for the entire athletics field.

TABLE OF ILLUMINATION READINGS

Station	Ft.-Candles	Station	Ft.-Candles	Station	Ft.-Candles
1	3.830	8	0.422	15	4.090
2	2.700	9	0.480	16	3.250
3	1.690	10	0.628	17	1.740
4	0.911	11	0.957	18	0.940
5	0.657	12	1.525	19	0.610
6	0.492	13	2.810	20	0.358
7	0.432	14	4.440	21	0.394

The area immediately in front of the grand stand where the fancy roping events were staged has an average illumination of 2.786 ft.-candles. This proved sufficient to enable these events to be seen in a very satisfactory manner.

The field is now used almost every night as a drill

ground for the home guard. When used for such purposes the lighting system on one side of the field only is turned on. This gives very satisfactory lighting for such work, although it naturally decreases from a comparatively high value on one side to a relatively low one on the other side. While at first thought it might seem that the extreme shadow condition resulting from lighting one side only might be objectionable, yet this has not proved to be the case, owing to the fact that the lighting is carried out over such a relatively great distance horizontally. Better lighting for this purpose would undoubtedly have resulted from turning every other light on each side of the field, but the additional cost necessary to secure this control has not yet seemed justified.

Here, as in many places, it was necessary to compromise between first cost and illumination results. The lamps as seen across the field are too low for absolute comfort, but the objection has not been so serious as was at first anticipated, and the public generally is very well pleased with the result.

SHALL THE EMPLOYEES BE TAKEN OVER WITH THE PLANT?

The Public Good Will Is Conserved by Choosing the Proper Men to Act as Local Managers for Interconnected Properties

In discussing his methods of handling men an executive of a Middle Western company recently stated that he had been able to notice in several instances the effect on the public occasioned by different methods of handling employees. The companies with which this executive is connected operate mostly in small towns and medium-sized cities which are interconnected by transmission lines. He stated that in the handling of these properties as a result of his experience he has adopted a policy of utilizing as far as possible all forces of men who have been employed by a company which is taken over.

Only in extreme cases, where it is impossible to teach these men new ideas and new methods, does he believe it wise to dispense with them altogether. Even before taking this step he sometimes finds it expedient to remove the man and his family to another community to discover whether or not the change will effect the proper awakening in the man himself.

In most cases it has been found that not only does the policy of retaining the old employees conserve the good will of the general public for the new company, but that the employees thus secured make good men for the larger concern. It is, of course, necessary to spend some money in educating the men, and to this end meetings at the headquarters of the company are held once a month for the local managers of the subordinate concerns.

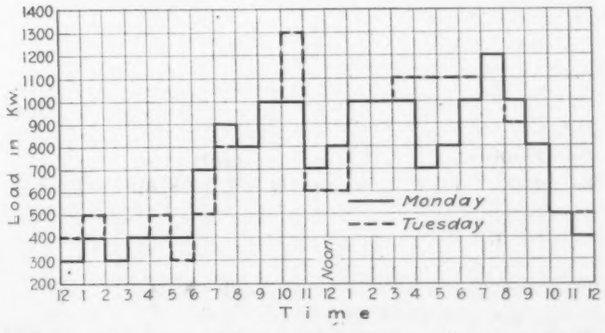
Moreover, local managers for these small properties may be found in almost any position in the company taken over. In some instances it has been found that men who are working as linemen make good local managers. These men are gathered together once a month, when the detailed problems of operation are discussed, and a specific effort is made to see that they become more enthusiastic about the interconnected company than they were about the concerns which formerly operated in the towns they now manage. That this plan works out well may frequently be inferred from the attitude of pride which these local managers exhibit in being connected with one of the largest industrial enterprises in their section of the country.

EFFECT OF FLATIRON LOAD ON THE CURVE FOR TUESDAY

Typical Plant Records from an Ohio Town of 5000 Show Clearly the Reasons for Small Towns Going After This Class of Business

The illustration herewith shows typical load curves taken from the plant of the Northwestern Ohio Light Company at Delphos, Ohio, a town of 5000 inhabitants, on a Monday and on a Tuesday. In this plant are two alternating-current turbo-generators totaling 2250 kw. and operating at 220 volts, three-phase, 60 cycles. The plant not only supplies electric service for Delphos but also sends out energy over a 33,000-volt high-tension line and a 13,200-volt feeder to a stone quarry. In Delphos the company is particularly fortunate in having an electric iron in the residence of practically every one of its 800 domestic customers.

The load produced by these 800 flatirons on Tuesday, which is the common ironing day, is clearly visible on the curve. These curves were not selected as those



COMPARATIVE CURVES OF SMALL COMPANY FOR MONDAY AND TUESDAY, SHOWING FLATIRON LOAD

which showed the worst possible exaggeration of conditions, but were taken as typical of the usual Monday and Tuesday curves. It will be observed that in the morning between 10 and 11 o'clock there is a peak extending 300 kw. above the usual station load. It will also be observed that the afternoon valley is more than filled on Tuesday. These two characteristics, according to H. W. Brunell, local manager of the property, are attributable entirely to the ironing load. It will be seen, of course, that the station load factor is somewhat lower on Tuesday than on Monday, owing to the increase in the station peak. It is probable, however, that if the flatiron load of Tuesday were added to the Monday curve the resulting load curve would be somewhat better.

There are some points on Tuesday's curve for which there is no explanation or which can hardly have any bearing on the flatiron load; for instance, the drop in load between the hours of 6 and 7 a. m., 7 and 8 a. m. and 11 a. m. and 1 p. m. It is true, however, that, as shown by the curves, the Tuesday killowatt-hour output is larger than that for Monday.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Checking Induction Motor Connections.—F. D. NEWBURY.—The author points out that the possible mistakes in connecting a three-phase winding are: (1) wrong number of coils in group; (2) a reversed group caused by interchanging the cross-connections of the group; (3) a reversed phase caused by interchanging the start and finish of the phase. The author proceeds to show how these mistakes may be detected and located by (1) their effect on the form of the magnetic field produced by the winding when single-phase current is passed through it, and (2) their effect on the impedance of the winding.—*Elec. Journal*, December, 1917.

The Development of Direct-Current Motors.—A. BRUNT.—The author discusses the subject of heating and ventilation, rating, efficiency, motor weights and economic features.—*Elec. Journal*, December, 1917.

Lamps and Lighting

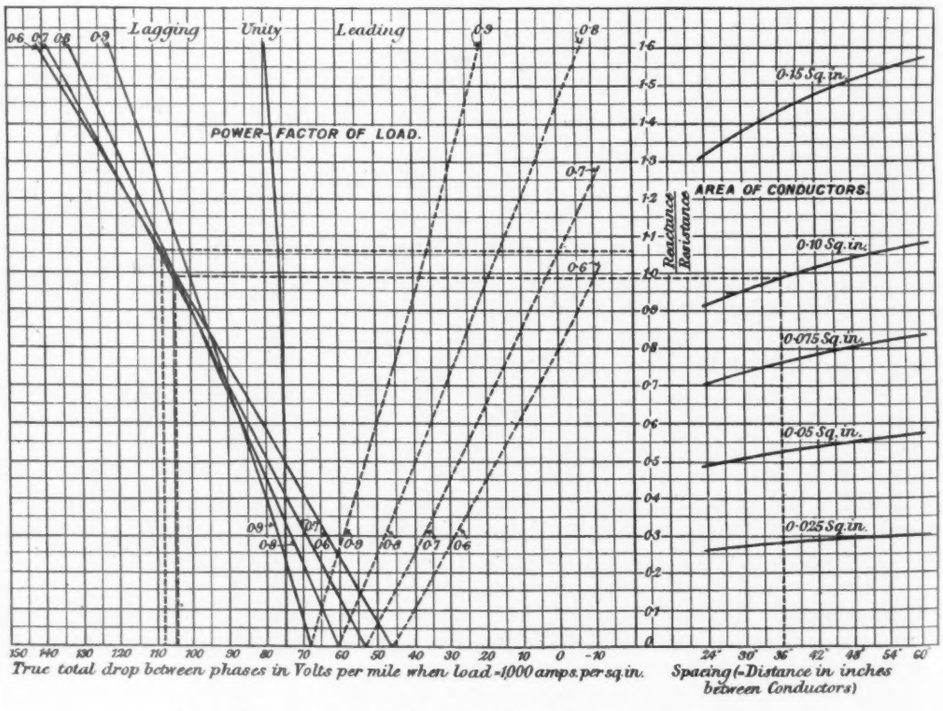
Operation of Series Incandescent Lighting Circuits with Series Transformers.—E. C. TREANOR.—The author describes the open-circuit and short-circuit characteristics of the series transformer and shows how these have been brought into agreement with the necessary and the desirable characteristics of the series incandescent circuit. The combined subject of grounding, operation and protection is analyzed.—*Gen. Elec. Review*, December, 1917.

Mazda Lamps for Motion Picture Projectors.—L. C. PORTER.—An analysis of the difficulties encountered in successfully developing an incandescent lighting system to replace the arc-lighting system which has been commonly used. A description is given of the manner in which these difficulties have been surmounted, the development of a special incandescent lamp and condenser and the addition of a spherical mirror being emphasized. The article is concluded by a table comparing the detailed operating cost of the new incandescent lamp with that of the arc lamp and showing that the former type is more economical than the latter.—*Gen. Elec. Review*, December, 1917.

Generation, Tranmission and Distribution

The Design of High-Voltage Insulators.—C. E. OLSON.—First of three installments calling attention to the requirements of insulators and discussing the dielectric strength of porcelain, surface resistance and the proportioning of parts.—*Sibley Journal of Engineering*, November, 1917.

Pressure-Drop Curves for Copper Overhead Lines.—G. N. WRIGHT.—The curve shown in the accompanying figure was drawn so that the true pressure drop (that is, the difference between the voltage at the generating end and the voltage at the receiving end) on a three-phase, 40-cycle overhead line at any load can be found readily and without complicated calculation. By working out numerous examples it has been proved that, though these curves were drawn for a 3000-volt line two miles (3.2 km.) long, with conductors symmetrically arranged and loaded to 1000 amp. per square inch (155 amp. per sq. cm.), the error for other commercial lengths and loading of line and other voltages is quite negligible—in fact, greater inaccuracy might be expected in taking a reading from the curve itself. The true drop when the load is other than 1000 amp. per square inch may be found by simple proportion. The curves will be found to be absolutely correct for a 3000-volt line two miles (3.2 km.) long, an 11,000-volt line 7⅓ miles (11.8 km.) long, a 20,000-volt line 13⅓



TRUE POTENTIAL DROP FOR CONDITIONS MENTIONED IN TEXT

miles (21.7 km.) long, or a 440-volt line 0.3 mile (0.5 km.) long, loaded to 1000 amp. per square inch (155 amp. per sq. cm.), or for double these lengths loaded only to 500 amp. per square inch (77.5 amp. per sq. cm.), or for half these lengths loaded to 2000 amp. per square inch (310 amp. per sq. cm.). Where the length of line is less or the current density lower, the curve reading will be slightly high, and, conversely, when the length is greater or the current density higher the curve reading will be slightly low; but, as mentioned above, the error is negligible, being less than 1 per cent for any commercial proposition. Alfred Hay's formula for inductance was used in the calculations, namely, inductance per mile of single-phase line in henries $= 14.8 \times 10^4 \log_{10} (d/r)$. Capacity has been regarded as negligible, it being assumed that the curves will not be used for voltages higher than those likely to be adopted in England. Besides being useful for calculations of voltage drops, the curves bring clearly to light the fact that though smaller conductors give higher inductance than larger ones for the same spacing, the ratio of reactance to resistance for small conductors is less, and therefore the actual drop is less at the same loading per square inch for loads with lagging power factors.—London *Engineering*, Nov. 9, 1917.

Repulsion Between Busbars.—S. G. LEONARD and CHARLES R. RIKER.—A chart of busbar characteristics is presented and correction factors for repulsion between strap conductors are given. All of the formulas given and the charts are for round conductors only. They are, however, sufficiently correct for practical purposes with rectangular conductors where the separation between straps is greater than the width. This covers nearly all commercial conditions, as a spacing to this extent is required to limit the safe arcing distance in high-voltage plants and in low-voltage plants of any considerable capacity.—*Elec. Journal*, December, 1917.

Installations, Systems and Appliances

The Relative Merits of Steam-Driven and Electrically Driven Station Auxiliaries.—V. PICKLES.—The author points out that the two chief factors deciding the choice of steam-driven and electrically driven generating station auxiliaries are reliability and running costs. Difference in capital cost scarcely affects the question, as expenditure on auxiliary plant forms a small proportion of the total cost. The merits of individual auxiliary apparatus are taken up and considered from both standpoints. The author concludes from his reasoning that, on the whole, an independent steam drive is generally better than an electric drive for generating station auxiliaries.—London *Electrician*, Nov. 16, 1917.

New Way to Burn Crude Oil.—W. A. JANSEN.—During the past year there has been developed a system of oil burning wherein the oil, instead of being atomized or vaporized, is gasified in a special designed vaporizer outside of the furnace. The gaseous product is forced into a combustion chamber under positive pressure. The air for combustion is delivered by a compressor at about 2 lb. (0.14 kg.) pressure and a velocity of 150 ft. (45.7 m.) per second. With the admixture of oil in the vaporizer, a gaseous product is formed which is delivered to the combustion chamber under continuous pressure.—*Iron Age*, Nov. 1, 1917.

Opening Blast-Furnace Tap Holes with Electric Arc.—The use of an electric arc for the purpose of removing metal lodged in the tap hole of a blast furnace has been tried out with success in several of the big Krupp works. Where non-conducting masses plug the hole the current is shut off for a moment and a steel rod is pushed into the mass, which then acts as conductor; 800 amp. to 1000 amp. are required.—Abstracted from *Licht und Lampe* in *Frankfürter Zeitung*, Oct. 4, 1917.

Electric Dumping Platforms.—WINTERMEYER.—Electric dumping platforms are being installed throughout Europe in ever-increasing number, and an exhaustive study of the subject, with many illustrations and calculations, has been made in this article. Of the greatest interest are installations for dumping cars into ships and boats from the shore where the height of the water level changes continually with the tides. The largest of these dumping installations is in Duisburg-Ruhrort, where seven "dumpers" handle an aggregate of 1050 railroad cars in a day of ten hours. The cargo handled is chiefly coal and ores.—Abstracted from *Elek. Kraftbet. u. Bahn.*, Nos. 19 and 20, 1917, in *Elektrot. u. Maschinen.*, September, 1917.

Wires, Wiring and Conduits

Phasing Out of High-Tension Lines.—E. C. STONE.—The correct connection is predetermined from the existing connection by the combined indication of a single-phase synchroscope and an ordinary two-phase motor. The synchroscope is used to find corresponding individual phases, while the motor by the direction of its rotation indicates which of the two possible transformer connections exists in the particular case under investigation. For parallel operation the synchroscope shows synchronism, and the motor must rotate in the same direction when like leads are connected to corresponding phases of the line or busbars. Charts are given to show what connections should be made when the synchroscope reading and rotation of the induction motor are known.—*Elec. Journal*, November, 1917.

Telegraphy, Telephony and Signals

Effects of Changes in Diaphragm on the Characteristics of the Telephone Receiver.—The observations indicate that the natural frequency of the telephone receiver is not proportional to the diaphragm thickness for at least one reason, that the thin diaphragms are subject to greater magnetic distortion. The observed sensitiveness reached a maximum for the particular instrument under consideration near the thickness of 0.23 mm. The resonant range diminished as the distance increased.—Report of Research Division Electrical Engineering Department, Massachusetts Institute of Technology.

Long-Distance Duplex-Working Central Battery System.—R. L. MILBURN.—In this system the apparatus at the home station consists of a double-current key with nine terminals, three top, three bottom and three movable, a polarized G. P. O. 200-ohm relay, a rheostat with condensers up to 30 microfarads, and a sounder and local battery. At the out-station the apparatus consists of a key, Vyle sounder and rheostat without any condenser. Three relays joined in series locally were used in place of the key.—London *Elec. Review*, Nov. 16, 1917.

Communicating by Wire and by Wireless "at the Front."—Owing to the danger of wireless communications being captured by the enemy, the Allied armies at the front resorted to telephone lines, but on account of the heavy bombardment it was soon found necessary to place these underground instead of in the air, and the depth at which they are laid has been constantly augmented until the possible limit in that direction has been about reached. Even yet, however, interruptions at critical moments are frequent. It is therefore suggested that wireless telegraphy should, after all, be resorted to, and that such installations be modeled after the plan said to be used by the Germans. That is, the electric source differs according to the strength of the stations, the feeblest using a small storage battery charged every two days, the strongest being supplied with an electric generator. The antennas are fixed 4 m. (13 ft.) above the ground, to which they are connected by a bare wire buried for a certain distance. The antennas are about 100 m. (328 ft.) long, and the stations emit waves 500 m. to 600 m. (1640 ft. to 1968 ft.) in length, or of the same order as those sent by the aeroplanes. The stations are fully manned and an incessant listening is maintained in the hope of intercepting messages from enemy aviators.—*L'Industrie Elec.*, Oct. 10, 1917.

Miscellaneous

Public Utility Service Standards of Quality and Safety.—This paper contains a brief outline of the public service activities of the Bureau of Standards, together with lists of subjects on which publications have been issued by the bureau. Among the public service activities are standards for electric service, national electric service codes and data on electrolysis indication, and the program of future activities covers a number of other compilations and investigations that will be of value to the electrical industry.—*Circular No.* 68, Bureau of Standards.

Capitalized Value of One-Tenth of an Inch Vacuum.—C. H. Baker.—Formulas and charts are given for calculating the capital that may be economically invested in condenser equipment for each 0.1 in. (2.5 mm.) of vacuum gained with steam turbines. Problems are also worked out to show the application of the charts.—*Power*, Dec. 4, 1917.

Heat Calculations for Baking and Drying Oven.—Wirts and Stodd.—In the baking and drying process heat must be supplied for the following purposes: raising the temperature of the work; raising the temperature of the part which is supporting or carrying the work; raising the temperature of the ventilating air; supplying the losses which occur from radiation, and in case of continuous operation, such as a kiln-type oven or the semi-continuous conveying type of oven, raising the temperature of oven walls, racks, etc., after each period of cooling. The author illustrates how each one of these calculations is made by assuming specific conditions and working out the example.—*Elec. Journal*, November, 1917.

Storage of Coal in Bulk.—The British Fire Prevention Committee has issued a special warning with regard to the storage of coal in bulk, with especial reference to spontaneous combustion. The following are some of the precautions that should be taken: (a) Stacks should not be higher than 10 ft. (3 m.). (b) Iron perforated pipes 3 in. or 4 in. (7.6 cm. or 10.2 cm.) in diameter, or, in the absence of these, either suitable earthenware pipes or ducts formed of incombustible material, should be inserted vertically in the stacks as they are built up. The lower ends of these pipes or ducts should be at different heights from the ground throughout the stacks. There should be one pipe or duct to about every 300 sq. ft. (27 sq. m.) of surface. (c) A thermometer should be lowered occasionally through these pipes or ducts to ascertain the temperature of the center of the stack. (d) If wet, very small, very soft or impure coal is received, it should be dumped around the edges of the stack, or in some location where the air can get to it freely and where other coal will not be packed on top of it.—London *Elec. Review*, Nov. 9, 1917.

Causes of German Coal Shortage.—Among the causes given for coal shortage in Germany are the underfeeding of the miners, their lack of experience and training, the unsatisfactory terms of the collective piecework contracts, lack of zeal in the workers, defective ventilation, poor blasting materials, defective tramway lines, and general shortage of cars, timber and other materials. At the present time about one-sixth of all employed in and about the mines are women and boys, lacking both in physical strength and training; but even among the men a large proportion are unskilled and have been recruited from every conceivable vocation. If the prisoners of war be included, the effect is to reduce the average efficiency of the mass still further.—*Die Konjunktur*, Aug. 30, 1917.

Water Power and Agriculture.—H. Cahen.—This publication in full of a paper presented to the water-power congress held at Lyons, France, in 1914, is still pertinent in considering the problems involved and interesting as an exposition of what was being done in Europe in the application of electricity to agriculture before the war. Its principal uses are summarized as lighting, electroculture, applications in the work of raising crops, in the interior work of the farm and in pumping and irrigation. Under the head of electroculture proper comes the use of electric energy to stimulate vegetable growth and to enrich the soil by the chemical decomposition of elements contained in it. Results thus obtained have been contradictory and all the factors are not yet sufficiently known, but it is established that nothing can be hoped for from atmospheric electricity, which is too hard to capture and too intermittent. Only from the application of manufactured energy at high tension can success be expected. In the practical work of sowing and harvesting, plowing and thrashing progress is constant and assured, and the same thing is true as regards the varied work carried on in barns, dairy work, the ventilation of hothouses, refrigeration and ice-making. Other projected or incompletely developed uses are in sterilization, rectification of alcoholic liquids, whitening of grain, extraction of casein from milk, incubation and the treatment of cows. The value of electricity for pumping and irrigation is, of course, incontestable. A detailed account of what has been accomplished along all these lines in various parts of Europe, of tariffs and costs, and of the part that should be played by organized groups of agriculturists, by the distributers of energy and by the government is given.—*Revue Gén. de l'Elec.*, Nov. 3, 1917.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

GENERAL POWER SITUATION BECOMING MORE SERIOUS

Government Work Hampered in Many Localities and Priority Orders for Power Likely to Be Issued in Congested Districts

Owing to the concentration of war orders in the Middle Atlantic and Middle States, electric power supply in those sections is rapidly nearing exhaustion because of lack of coal, generating equipment or a combination of both. Isolated plants having proved unequal to the emergency, the government has asked one large New England central station, for instance, to connect an important munitions plant to its system. This will involve quite an outlay for a transmission line, inasmuch as the munitions plant is some distance from the lighting company's circuits.

For some time the power situation at Niagara Falls has been acute. The government has made an arrangement with the Canadian authorities whereby the threatened curtailment of electrical energy from Canada will not take place, and conferences are now proceeding at Niagara Falls between American and Canadian authorities with a view to distributing the electrical energy generated along the Niagara frontier equitably.

PRIORITY ORDERS FOR POWER

Orders have been issued to public utilities and power plants in the Pittsburgh district to give preference to plants engaged in war work. The priorities committee of the War Industries Board of the Council of National Defense has issued certificates which in effect constitute the establishment of a preferred class of industries and follow closely the lines of the requests of Dr. Garfield of the Fuel Administration that coal operators supply certain consumers first. The power companies are expected to serve last those plants to which certificates are not granted. In this way it is hoped that the slowing up of the manufacture of munitions through lack of adequate power will be averted.

The preferred list of consumers will be subject to constant revision by the priorities committee as local conditions change. The priorities certificates were issued in the Pittsburgh district only after careful study had shown that they were absolutely essential to the national interest. It is anticipated that the order will probably cause some inconvenience at first but that a judicious allotment of electric power and proper adjustment on the part of the industry to meet the new conditions will prevent any hardship.

The large amount of war order business turned out near the great seaport cities on the Atlantic Coast north of Washington, it is anticipated, will call for some government action to conserve the power supply there. In many instances the shortage has been due to lack of fuel, while in some other instances the shortage has been due to lack of generating equipment. Serious shortage of power for war work has also been experienced in the eastern section of Ohio, due chiefly to lack of fuel. So far the government has not been seriously hampered for want of electricity south of Maryland or west of Ohio, except at one of its own plants in the Middle West. It is of interest to note that the district where power shortage has been most acute is also the district suffering most for lack of fuel. Extensions called for by the government have resulted in at least two utilities asking for government help in securing necessary capital to make the extensions, the utilities themselves not being able to raise the funds.

There now exists also great confusion among the manufacturers of steam generating equipment owing to the congestion of priority orders from military authorities. Manufacturers of steam turbines have been in consultation with the government on this matter, and it is the expectation that conditions of congestion may be remedied by a co-ordination of the work and by closer co-operation between the various military departments. Difficulty has been experienced in meeting all of the power requirements of war industries owing to the lack of large transformers and in some cases of large motors. Steps have already been taken to remedy this matter, and manufacturers of this equipment have willingly placed all of their facilities at the service of the government. It is expected, however, that by a proper allotment of the work the ordinary business of electrical manufacturing companies, which is also now at its height, will not be seriously interfered with.

LISTING POWER USERS

In many instances power companies appealing to the Fuel Administration for fuel have been requested to list all of their power users in the order of their importance to the government in the successful prosecution of the war. This listing has been made in anticipation of possible curtailment of service to those industries which might be considered less essential. Power companies in many sections have approached this task with hesitancy and have been loath to accept the responsibility of deliberately cutting off the supply of electrical energy to any industry without proper governmental authority. The companies seek to be protected against lawsuits owing to non-fulfillment of power contracts.

It is very generally felt in Washington that the priorities committee which has issued certificates for power is without authority to issue such orders formally and legally, but there is understood to be an official view that if the power companies do not meet its wishes and recognize the certificates there is the possibility that the districts affected will fail to get future government contracts and coal.

Every manufacturing plant on the high-tension lines of the Georgia Railway & Power Company received a telegraphic request from that company to shut down

entirely for twenty-four hours beginning midnight Tuesday and continuing until midnight Wednesday. President P. S. Arkwright explained that the shortage of coal and the low stage of water in the streams feeding the company's great hydroelectric plants made this step imperative. It is the expectation that a complete shut-down for twenty-four hours will enable the power company to store sufficient water back of the dams and in the reservoirs to enable it to tide over power shortage temporarily at least. It will also enable the power company to get sufficient coal for its auxiliary steam plants.

WATER-POWER ACT IS PASSED BY UNITED STATES SENATE

Bill Providing for the Improvement of River Navigation by Private Capital and Utilization of Resulting Water Power Is Carried

On Dec. 13 Senator Shields of Tennessee presented a report from the committee of commerce accompanying a bill to amend the act to regulate the construction of dams across navigable rivers. The report said in part:

The bill provides primarily for the improvement of navigation in rivers under the jurisdiction of Congress with private capital, as distinguished from appropriations by Congress for that purpose, and secondarily for the development and utilization of the water power of those rivers resulting from such improvement, as well as that created by dams constructed and to be constructed under the authority of Congress. The secondary purpose of the bill is the inducement for the investment of private capital in the improvement of navigable streams and without which it would not be so invested or improvements made.

It is estimated that there is in the navigable rivers of the United States, exclusive of Alaska, and also of what may be developed by feasible storage projects, over 61,000,000 hp. of water-power energy, not more than one-tenth of which is now improved and utilized.

The economic and industrial advantages to the people of the United States that will result from the development of hydroelectric energy produced by utilization of water powers are difficult to overestimate.

It is believed that under the provisions of this bill the water-power resources of the country will be developed and utilized and future waste prevented, which is conservation in its highest and truest sense.

The bill was debated on Dec. 14 for about three hours, many of the Senators, especially those from the water-power States, indorsing it. It was passed by a vote of forty-six to eighteen, thirty-one not voting.

The principal objects of this bill are thus summarized by Senator Jones of Washington:

1. For the improvement of the navigation of rivers without cost to the government in connection with dams constructed for hydroelectric purposes in navigable streams.

2. For grants by the Secretary of War of authority to private parties for the construction and maintenance of such dams when navigation facilities can be improved thereby, such authority to extend for fifty years and until the property necessary for such a development is taken over and just compensation paid for it either by the government or a duly authorized new grantee.

3. For diligent construction, completion and operation of such dams, subject to market conditions.

4. For the construction by the grantee of suitable locks, without cost to the government, when required by the Secretary of War.

5. For payment to the government by the grantee of the cost of any investigation necessary to the issuing of the grant and the cost of such supervision of construction as may be necessary; and also the payment by the grantee of reasonable charges for benefits resulting from headwater improvements installed by the government and payment to the government of a reasonable price for the use of any public land taken.

6. For the regulation of the rates and service of the grantee by state authority, or, if the business is interstate, by the Interstate Commerce Commission, thereby assuring to consumers efficient service and fair, just and reasonable rates.

7. For reserving to the state authority over the waters and water powers subject to the paramount power of Congress over navigation, and for reserving also all the taxing powers of the states in relation to the properties.

8. For uniform accounting and examination of the books of grantees by the Secretary of War.

9. For leasing under similar conditions the right to utilize surplus water generated at dams constructed by the government.

METHOD OF PROCEDURE IN WAR INDUSTRIES BOARD

A Plan for Satisfying War Needs Contemplates the Issue of a Daily List of New Government Requirements

The electrical division of the War Industries Board has issued the following bulletin, dated Dec. 15, dealing with questions of procedure:

In quick response to our bulletin indicating a shortage in capacity for production of large units, several companies have offered to expand their capacity. A plan for satisfying war needs contemplates sending a letter every day listing new requirements. These lists will be sent to all companies prepared to undertake any part of the requirements. If the inquiries develop in sufficient volume, a regular day for allocation each week will be named. As the inquiries come in by mail manufacturers are expected to review their shop schedules in the departments that would perform the work. Each manufacturer will exercise his own judgment as to sending a representative to Washington for the weekly meeting.

Mr. Collens, chairman of the war service committee, has been asked to complete the plan for these meetings and to be ready to place the plan in full operation next week should the volume then so justify. This procedure will not only prevent increase in congestion but will also indicate whether we now possess capacity equal to the demand.

The indications at present are that the situation as to large transformers and other substation apparatus is more congested than on motors. We may wish to add transformers for similar allocation as to sources of supply at these weekly clearance meetings. If so, transformer manufacturers will be asked to adopt similar procedure. Please note that adoption of this plan of clearing demands against supply does not obligate any company actually to attend if from its point of view the volume and its prospects with reference thereto do not justify. When you decide not to attend we ask that you give by mail the best picture or tabulation or answers you can, taking care to post your letters in time to reach us the day of the meeting, when that has been set by Mr. Collens.

On small motors in general we have developed stocks which will answer so large a portion of the immediate needs without requiring new manufacture that practically all appearance of shortage has disappeared. Such shortage as does exist is only spotty and will probably remedy itself by natural evolution. Possibly it may later on be advisable to assist certain machine-tool builders to secure alternate supply for motors. As this would require new development in most cases the move will only be made in case of absolute necessity.

Several companies have sent us no stock bulletins or statements as to shipment since July of orders intended for export. Others have sent us one bulletin as to equipments in stock, but have not sent revision weekly or at the latest bi-weekly. Their lists must be rejected entirely as unreliable after two weeks.

SPEEDING WORK OF THE WAR SERVICE COMMITTEES

Conference of Chairmen of Group Committees of Associated Manufacturers of Electrical Supplies to Help the Government

A conference of chairmen of the group war service committees of the Associated Manufacturers of Electrical Supplies and Robert K. Sheppard and J. R. McKee, the representatives of the association on the general war service committee of the electrical manufacturing industry, was held at the association offices, New York, on Wednesday of this week. It supplemented the meeting of members at Delmonico's, New York on Dec. 13, mentioned in last week's issue of the ELECTRICAL WORLD.

The conference this week was held for the purpose of speeding and sucessfully organizing the work of the individual committees. It is the intention of these committees, following the policy of the association, to give the government every possible assistance in getting in the shortest time the electrical supplies which it needs to prosecute the war to a victorious conclusion. Organization will be effected on the basis of patriotic service to the government. The services of the committees will be available to all manufacturers, without regard to whether they are or are not members of the association.

The spirit of the meeting of members of the association on Dec. 13 is shown by the following resolution, passed unanimously at that gathering:

Resolved, that we, the manufacturers of electrical supplies in special meeting assembled here, hereby approve the action of the board of governors of the Associated Manufacturers of Electrical Supplies in appointing representatives on the general war service committee of the electrical manufacturing industry.

We pledge our support to that committee.

We pledge our manufacturing facilities for the welfare of the United States of America and shall seek through our several industry committees and the general war committee for methods to accomplish all that our individual and united facilities can contribute to the winning of the great war in which we as a nation are now engaged.

THE ENGINEERING COUNCIL URGES DRAFT LAW CHANGE

It Indorses the Movement to Modify Draft Law so as to Permit Students at Engineering Schools to Complete Their Studies

A meeting of the Engineering Council was held on Dec. 6 in the new board room of the American Society of Civil Engineers, New York.

A committee which has been searching for some time for a permanent secretary for the Engineering Council, for the United Engineering Society and for the Engineering Foundation unanimously recommended Alfred D. Flinn. The resignation of Calvert Townley, who had held office since the organization of the Engineering Council, was accepted with expressions of appreciation for services rendered, and Mr. Finn was elected, effective Jan. 1, 1918.

The matter of the administration of the national selective draft law with respect to students in engineering schools having been recommended for consideration, a resolution was adopted and telegraphed to Secretary of War Baker and General Crowder.

WAR SERVICE COMMITTEES OF ASSOCIATED MANUFACTURERS

Various Groups Appoint Members of Committees to Co-operate with General Committee of the Electrical Manufacturing Industry

Following conferences of members of the Associated Manufacturers of Electrical Supplies with Robert K. Sheppard and J. R. McKee, the representatives of the association on the general war service committee of the electrical manufacturing industry, the various groups have appointed co-operating war service committees. These committees are:

Molded or Formed Insulation Group.—R. W. Seabury, chairman, Boonton Rubber Manufacturing Company; E. B. Hatch, Johns-Pratt Company; Joseph Rockhill, General Insulate Company; B. H. Howell, Garfield Manufacturing Company.

Panelboard and Switchboard Group.—Charles L. Eidlitz, chairman, Metropolitan Electrical Manufacturing Company; H. F. Krantz, Krantz Manufacturing Company; William T. Pringle, Pringle Electrical Manufacturing Company; F. T. Wheeler, Trumbull Electrical Manufacturing Company.

Line Material Group.—H. G. Lewis, chairman, Electric Service Supplies Company; J. W. Perry, H. W. Johns-Manville Company; A. L. Johnston, Electric Railway Equipment Company.

Porcelain Group.—H. R. Holmes, chairman, R. Thomas & Sons Company; B. B. Dinsmore, Imperial Porcelain Works; C. W. Kettron, Illinois Electrical Porcelain Co.

Carbon Group.—J. F. Kerlin, chairman, National Carbon Company; G. P. Fryling, Speer Carbon Company.

Metallic Flexible Conduit and Armored Conductor Group.—F. W. Hall, chairman, Sprague Electric Works; V. C. Gilpin, Triangle Conduit Company; G. F. Holly, Youngstown Sheet & Tube Company.

Non-Metallic Flexible Conduit Group.—W. H. Thornley, chairman, Tubular Woven Fabric Company; D. H. Murphy, American Conduit Manufacturing Company; Russell Dart, Alphaduct Company.

Rigid Conduit Group.—D. H. Murphy, chairman, American Conduit Manufacturing Company; F. C. Hodkinson, Safety Armorite Conduit Company,; J. S. Patterson, Enameled Metals Company.

Industrial and Street-Lighting Fixture Group.—H. W. Bliven, chairman, Harvey Hubbell, Inc.; A. D. Fishel, Adams-Bagnall Electric Company; D. K. Chadbourne, George Cutter Company.

Lighting Fixture Group.—Herman Plaut, chairman, L. Plaut & Company; F. W. Wakefield, Wakefield Brass Company; Albert Ullman, Scott-Ullman Company.

Wire and Cable Group.—LeRoy Clark, chairman, Safety Insulated Wire & Cable Company; Edward Sawyer, Atlantic Insulated Wire & Cable Company; Wallace S. Clark, General Electric Company.

Wiring Devices Group.—J. C. Dallam, chairman, General Electric Company; Attachment Plug Section, H. W. Bliven, Harvey Hubbell, Inc.; Fuse and Cut-out Section, J. W. Perry, Johns-Manville Company; Knife Switch Section, J. H. Trumbull, Trumbull Electrical Manufacturing Company; Snap Switch Section, Shiras Morris, Hart & Hegeman Manufacturing Company; Socket and Receptacle Section, F. V. Burton, Bryant Electric Company.

Outlet Box Group.—H. D. Betts, chairman, Thomas & Betts Company; A. I. Appleton, Appleton Electric Company; H. G. Knoderer, National Metal Molding Company.

Fan Motor Group.—W. W. Mumma, chairman, Robbins & Myers Company; A. D. Fishel, Adams-Bagnall Electric Company; M. C. Morrow, Westinghouse Electric & Manufacturing Company.

Metal Molding Group.—C. E. Corrigan, chairman, National Metal Molding Company; D. H. Murphy, American Conduit Manufacturing Company.

Insulating Materials Group.—J. B. Adams, chairman, Irvington Varnish & Insulator Company; W. R. Williams, General Electric Company; F. Y. Stewart, United States Rubber Company.

SUCCESSFUL MEETING OF A. I. E. E. IN NEW YORK

Features of Papers and Discussions Presented at Three Hundred and Thirty-fifth Meeting of American Institute of Electrical Engineers

Two papers were presented at the Dec. 14 meeting of the A. I. E. E., one of which was considered as contributing some valuable information on the flux and iron-loss distribution in steel laminas, while the other, on "Phenomena Accompanying Transmission with Some Types of Star Transformer Connections," was criticised rather severely by some members as not representing the average conditions which exist.

The first paper, which was entitled "Magnetic Flux Distribution in Annular Steel Laminas," was presented by Dr. A. E. Kennelly and Lieut. P. L. Alger, who explained how the experiments were conducted in studying this subject, what results were obtained and the causes of the phenomena noticed.

It was pointed out that the flux density in different belts of an annular lamina not only differ in r.m.s. magnitude but also in wave form. The distortion is very marked at low densities and is complicated at high frequencies by skin effect. Even if the total flux is sinusoidal the individual belt fluxes may be non-sinusoidal. In general, the external belt flux is the most distorted. The magnitude of the flux density distortion depends upon the width-radius ratio of the lamina (width of lamina plus geometrical mean radius).

The second-mentioned paper, by Lloyd N. Robinson, contained the following conclusions: Hysteresis, as well as variation of permeability, gives rise to harmonics of considerable magnitude in the exciting current of a transformer. For transmission lines of moderate lengths the effect of the line is to reduce the third harmonic voltage between neutral and line terminals of a star-star-connected bank of transformers having grounded neutral on the line side only.

In transmission with star-star transformer banks having grounded neutral on the line side only the interrelation of line susceptance from conductor to ground in series with the varying susceptance of the individual transformers may cause the total mmf. of one of the transformers to pass through zero at the same instant as the impressed emf., and thus give opportunity for a reversal of this transformer due to inertia, thereby producing a periodically reversing leg and abnormal voltages. In a similar system with high-quality line insulation the effect of atmospheric charges on the line conductors may be to cause the transformer of the bank to assume relations with one leg permanently reversed when energized from the station side, thus imposing unbalanced voltage conditions on the bank and producing in two of the units fundamental-frequency components of voltage 264 per cent of normal.

Combinations and accentuations of the above causes may, through natural requirements, give rise to a double-frequency pulsation of the potential of the hypothetical neutral of the line conductors, thus producing in the leg voltages second harmonic components of extremely large dimensions, perhaps limitless.

Both papers aroused considerable discussion. Among those taking part were B. A. Behrend, L. W. Chubb, V. M. Montsinger, J. B. Taylor, C. O. Mailloux, A. M. Dudley and F. W. Peek, Jr.

Mr. Chubb did not agree with many of the explanations made in Mr. Robinson's paper, notably that the harmonic components of the exciting current are not wattless, that the medial lines of hysteresis loops and the sine component of the exciting current represent variations in permeability, and that current resonates between the grounded conductor and the grounded neutral. He then presented his theory of the cause of the phenomena noted by Professor Robinson, saying that the inductance of a transformer varies with the flux density, and that if a condenser is connected across the terminals there may be resonance with certain flux densities. With resistance in series the current will continue to resonate even after the voltage has been reduced. He expressed the belief that the phenomena noted could not have been due to a reverse leg as an over-saturated transformer would have an excessive exciting current if this condition existed.

Discussing Dr. Kennelly's paper, Mr. Chubb said that he did not believe that the magnetic flux would divide according to the reluctance. Attention was called to the excessive iron losses which may be caused by bending lamina, a curvature equivalent to 60 deg. between tangents one inch apart increasing the apparent loss as much as 100 per cent. The eddy currents between lamina may be considerable, while paint may retard the flux and cause a sharp peak in the exciting current.

Mr. Montsinger outlined some of his investigations which were explained before the A. I. E. E. in 1914, calling attention to the fact that he had noted many effects that Professor Robinson had, but had failed to observe any reversed leg effects. Since triple-frequency voltages may be 60 per cent of the fundamental with ordinary flux densities, he contended that Professor Robinson failed to see the higher harmonics due to the low density used. The effect which Professor Robinson attributes to a reversal of transformer leg might be caused, the speaker pointed out, by the fact that the voltage between terminals is fixed, but unbalanced charging current flowing through the transformer might increase the voltage between one terminal and neutral enough to shift the phase relation between the neutral-to-terminal voltages, with a reversed-leg effect.

Mr. Taylor said that it is outside of comprehension how even harmonics can occur without a spark gap, magnetic bias, or a loose connection. He expressed the belief that Professor Robinson's paper was too wholesale a condemnation of the Y-Y connection. Professor Jackson took a more lenient attitude, and Mr. Dudley pointed out that figuring iron losses and segregating them is the most difficult task in design.

Dr. Kennelly pointed out that if flux is put into a circuit at a different rate from that at which it comes out even-frequency harmonics can be produced. Referring to his own paper, he said that the hysteresis loss in iron is not affected considerably by the wave form as long as the same maximum value exists. However, the eddy-current loss is increased with the number of kinks in the wave form. Thus the losses may be considerably greater than the calculated value.

In concluding the discussion in the absence of the author of the paper, Mr. Peek said he could not follow the part about the reversed-leg voltage, that there were not sufficient data to explain why the harmonics were even and that the author had, in his opinion, overestimated the troubles due to the new phenomena noted.

ELECTRICAL CONTRACTORS IN ARMY CONSTRUCTION WORK

General Littell of the Quartermaster's Department Advises Conference Club Committee of New Government Policy

BY L. K. COMSTOCK

In the issue of the ELECTRICAL WORLD for Sept. 8, 1917, an article was printed in which was given the electrical construction engineers' point of view in regard to the quartermaster's policy when requiring general contractors to perform electrical work.

There was nothing stated explicitly in the contract used between general contractors and the government requiring the execution of electrical work by general contractors, but the net effect of the rules of procedure promulgated by the Quartermaster's Department for the guidance of constructing quartermasters in the field amounted to a most explicit direction to general contractors to execute all electrical work involved in their contracts.

On Nov. 3, 1917, the Washington committee of the Conference Club addressed to General Littell of the Quartermaster's Department the following letter:

Acting on the advice of Major Marshall, with whom the undersigned committee had an interview on Nov. 1, we desire to bring to your attention and ask your consideration of some reasons why the Quartermaster's Department of the army should alter its policy with respect to the employment of sub-contractors in mechanical lines but more especially in electrical work.

First—Electrical equipment contractors are more familiar with the technique of the business than others, therefore,

Second—They can produce such equipment for less money, in less time and with less lost motion than any one else.

Third—The electrical equipment contractor can regulate and distribute the supply of labor with less disturbance to regular business than any one else.

Fourth—By placing such contracts with electrical contractors the government will avail itself of a highly organized department of business, and

Fifth—The government will cease to lend its influence to the destruction of a business and at the same time will encourage a business to which in normal times it has freely and profitably given its patronage.

We ask for an appointment with you to discuss these arguments and present others.

In reply to the above letter, General Littell wrote as follows:

1. Replying to your letter dated Nov. 3, 1917, asking for an appointment to discuss questions relating to policy with respect to employment of sub-contractors in mechanical lines, especially in electrical work, you are informed that the undersigned will be glad to meet your committee on Thursday afternoon, Nov. 8, at 2.30 p. m.

2. Advise at once whether you are coming.

By authority of the Secretary of War.

On account of the extremely short time between the writing of the above letter and the date of the appointment, only three members of the committee were able to reach Washington, but the appointment fixed by General Littell was kept, and the matter referred to in correspondence above was discussed at great length by members of the Washington committee and General Littell and members of his staff.

On Nov. 9, the next day following our meeting with General Littell and his staff, the chairman of the Washington committee received the following letter:

Referring to your letter of the 3d instant and the conference had with your committee yesterday, I have to thank you and your committee for the privilege of so freely discussing the questions referred to in your letter.

This office fully appreciates the arguments presented by your committee, and you are hereby assured that in future work the sub-contracting of electrical work will be favorably considered.

It is very gratifying to be able to state that the Quartermaster's Department has signified its intention to make use of the electrical contracting industry in future work required by the Quartermaster's Department.

"LIGHTLESS NIGHT" ORDER OF FUEL ADMINISTRATION

Amended Ruling on Sign Restrictions Prescribes Sunday and Thursday as Nights for White Ways to Disappear

The United States Fuel Administration in an amended order issued on Dec. 14 put into effect "lightless nights" on Sunday and Thursday of each week. The first "lightless night" was Dec. 16.

Under the new order the "white ways" of all cities are to disappear absolutely on the nights designated. The burning of lights contrary to the wording and spirit of the order will constitute a violation of law, and steps will be taken by the Fuel Administration to mete out punishment to offenders.

The only exceptions apply to lights used for governmental purposes only by the United States government or the government of any commonwealth or state and street lights used by any city or town or within any city or town under a contract with the official thereof for such maintenance. No "white way" or cluster lights may be used under any circumstances. State fuel administrators are directed and authorized to see that the provisions of the order are observed scrupulously.

In addition to the saving of a large quantity of coal, it is believed by the Fuel Administration that "lightless nights" will provide startling visual evidence that the United States is in the greatest of world wars. Letters received by the Fuel Administration from companies and individuals engaged in supplying illuminated signs and from manufacturers, merchants, motion-picture and other entertainment concerns which make large use of such signs give assurance that the new order will become fully effective without resort to prosecution. The original Fuel Administration order on the dimming of electric signs had failed of the coal-saving result expected.

Dr. Garfield in promulgating the new order said: "Use of fuel in this emergency for any of the purposes definitely prohibited in the order is wasteful and is prejudicial and injurious to the national security and defense." The Fuel Administration desired that, in compliance with the patriotic spirit of the order, householders shall observe the "lightless nights" by burning as few lights in homes as it is possible to get along with conveniently.

The order of the Fuel Administrator, which supplements the original order published in the ELECTRICAL WORLD of Nov. 17, 1917, follows:

The order of the United States Fuel Administrator, dated November 9, 1917, entitled "Order of the United States Fuel Administrator regulating the use of coal for the purpose of

generating electricity for use in operating illuminated advertisements, notices, signs, etc.," is hereby amended to read as follows:

It appearing to the United States Fuel Administrator that it is essential to the national security and defense, the successful prosecution of the war and the support and maintenance of the army and navy, and to lessen or prevent the waste of fuel which at the present time is and during the continuation of the war will be, in the judgment of the United States Fuel Administrator, needed for the purposes aforesaid, and to secure an adequate supply and equitable distribution, and to prevent, locally and generally, scarcity of fuel, and to facilitate the movement of fuel for the purposes aforesaid, that the use of fuel in the manner and for the purposes hereafter set forth, and that the employment for such use of the present facilities already inadequate for the prompt and sufficient shipment, transportation and delivery of fuel needed for the purposes aforesaid, should be limited and restricted, in order that the essential purposes first hereinbefore referred to may be carried out, and that so far as possible the production, sale, shipment, distribution and apportionment of fuel among dealers and consumers, domestic and foreign, may be maintained to the extent sufficient to meet the governmental, commercial and domestic requirements for fuel,

The United States Fuel Administrator, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said administrator, and in furtherance of the purpose of said order and of the act of Congress therein referred to and approved Aug. 10, 1917,

Hereby adjudges that in his opinion the use of fuel for any of the purposes hereinafter described except to the extent hereinafter indicated is wasteful, and that any person using any fuel for such purposes except as aforesaid is engaging in a wasteful practice or device in handling or dealing with fuel, and that the use of fuel for such purposes except as aforesaid is prejudicial and injurious to the national security and defense and a cause of scarcity, locally and generally; and,

Hereby orders and directs that until further or other order of the United States Fuel Administrator, and subject to modification hereafter from time to time and at any time,

No corporation, association, partnership or person engaged wholly or in part in the business of furnishing electricity for illumination or power purposes, and no corporation, association, partnership or person maintaining a plant for the purpose of supplying for their own use electricity for illumination or power, shall use any coal, oil, gas or other fuel for the purpose of supplying electricity for illuminating or displaying advertisements, notices, announcements or signs designating the location of an office or place of business, or the nature of any business, for electric searchlights, or for external illumination for ornamentation of any building, or lights in the interior of stores, offices or other places of business when such stores are not open for business, excepting such lights as are necessary for the public safety or as are required by law; nor for excessive street lighting intended for display or advertising purposes, whether such lights are maintained by the municipality or by others.

These prohibitions and all of them are effective on Thursday and Sunday nights only of each and every week, subject to the following exceptions:

(a) This order shall not apply to light used for governmental purposes only by the United States government, the government of any commonwealth or state of the United States;

(b) This order shall not apply to the maintenance of street lights by any city or town or within any city or town under a contract with the officials thereof for such maintenance; except that no municipality may use fuel for the maintenance of lights commonly known as "white way" or cluster lights, or other decorative street lighting, or enter into a contract for the lighting of the same, except to such extent as such lights are necessary for the safety of the public.

(c) This order shall not apply to such porch lights upon houses or hotels or to entrances to buildings occupied or open for ingress or egress during the night time, or to lights upon private driveways, walks, or in the grounds of any hotel, manufacturing establishment or residence, or upon the platform of railway stations, approaches thereto or in railroad yards or grounds, as are necessary to safety, or to lights for any similar purposes when authorized by any State Fuel Administrator of the State within which such lights are located. Provided, however, that such lights shall be only in such number or size as is necessary to meet the requirements of public safety, and provided that such lights shall be reduced at any time upon direction of the State Fuel Administrator of the State within which such buildings or grounds are located.

The state fuel administrators within the several States are hereby directed and authorized to see that the provisions of this order are observed and carried out within their several states, to report violations thereof to the United States Fuel Administrator, and to recommend to the United States Fuel Administrator action to be taken by him with respect to the sale, shipment, distribution and apportionment of coal to the corporations, associations, partnerships or persons so found to be acting in violation of this order.

FEDERAL LIGHTING ORDER AND HYDROELECTRIC POWER

National Fuel Administrator Suggests to California Official Co-operation on Patriotic Basis to Follow Spirit of Ruling

The Federal Fuel Administrator's recent order for two lightless nights weekly was not specific as to energy from hydroelectric sources, so the California State Fuel Administrator wired for further instructions and received the following reply:

"New electric sign ruling does not cover hydroelectric power, but suggest you strongly urge, on patriotic basis, co-operation of power companies and consumers to follow the spirit of the ruling to eliminate all unnecessary lighting on Thursday and Sunday nights."

DAYTON IS TO DISCONTINUE FLAT-RATE SIGN LIGHTING

Conditions Make It Necessary to Put Display Illumination on Separate Meter, in Some Instances Adding Demands to Compute Rate

The Dayton (Ohio) Power & Light Company, previous to receiving the officially signed order regulating the use of electricity in illuminated advertisements, notices, etc., made a survey to ascertain the feelings of customers regarding such a restriction. While customers showed a readiness to co-operate with the government in any necessary measure, they expressed a recognition of the value of electric signs that will be a good sales argument when the war is over and the sale of electricity for this purpose can be pushed.

In complying with the order of the United States Fuel Administrator in a city the size of Dayton it has been found almost impossible to continue a flat-rate schedule for such lighting with patrolmen. The company has therefore requested permission of the Ohio Public Utilities Commission to withdraw its flat-rate schedule. It is the intention to bill customers for this service at the regular demand lighting rate. In instances where the sign is at the customer's usual place of business it has been proposed that the consumption of the two meters be added together and the two demands computed to arrive at the rate.

VOLUME OF 1917 ORDERS OF GENERAL ELECTRIC COMPANY

Estimated Amount of Orders Received During Current Year Now Stated at $240,000,000—Stock Dividend Policy

From the official notice to General Electric Company stockholders of the special meeting to be held on Jan. 3, 1918, to authorize an increase in capital stock from $105,000,000 to $125,000,000, it appears that the estimated amount of orders for 1917 is now $240,000,000. The previous estimate, given out in connection with the initial announcement of the new stock issue, was $230,000,000. The company has now no orders for war munitions.

The notice to stockholders, signed by C. A. Coffin, chairman of the board, contains substantially the same particulars given in the early announcement, published in the ELECTRICAL WORLD of Dec. 1, 1917, page 1066. It says in part:

"The directors have preferred to adopt the policy of paying semi-annual stock dividends at the rate of 4 per cent per annum in addition to the regular 8 per cent cash dividends, rather than to increase the cash dividends or distribute a larger stock dividend at this time."

MILITARY SERVICE FOR ENGINEERING STUDENTS

Letter of Committee of Association of American Universities Preceding New Ruling by the Provost Marshal General

After careful consideration a new ruling has been made by the Provost Marshal General on the position of engineering students in military service. The ruling, published in the ELECTRICAL WORLD for Dec. 15, 1917, page 1161, places selected students in the enlisted reserve corps of the engineer department of the army.

Before this action was taken a committee representing the Association of American Universities appealed to Secretary of War Baker on the ground that it was to the national interest that specially trained men be reserved for special service. This committee consisted of Armin O. Leuschner, chairman; Ray L. Wilbur and Dr. Arthur E. Kennelly. The letter of the committee said in part:

The Association of American Universities requests that the privilege of enlistment accorded to the medical profession, including students and internes, under orders of the War Department, office of Surgeon General, dated Sept. 4, 1917, be extended as follows:

To the engineering professions—civil, mechanical, electrical, mining and metallurgical engineers and geologists—including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Engineers' Reserve Corps or in such other branch of the service as you may direct.

To chemists, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Chemical Service Section of the National Army, or in the Ordnance Reserve Corps or in the Signal Reserve Corps or in such other branch of the service as you may direct.

To physicists, meteorologists and astronomers, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Ordnance Reserve Corps or in the Signal Reserve Corps or in such other branch of the service as you may direct.

To bacteriologists, physiologists, physical chemists, biologists, zoologists, pathologists, anatomists, men trained in public health, hygiene or sanitation, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in the Medical Reserve Corps or in such other branch of service as you may direct.

To agriculturists and botanists, including junior and senior students and graduates in educational institutions, with the privilege of enlisting in an Agricultural Service Section of the National Army or in such other branch of service as you may direct.

The Association of American Universities further requests that pending the elaboration of the details incident to the creation of these privileges the professional men under consideration be placed in Class 3 of the new classification of drafted men, or that agriculturists be classified as food producers.

These requests are prompted by the firm conviction that, if granted, the most efficient service of scientifically trained men will be secured for the conduct of the war, and that some of the unforeseen, unfortunate complications which have resulted from the first draft will be obviated.

During its recent session at Iowa City the Association of American Universities wired to the President a unanimous resolution expressing unswerving loyalty and support in the present crisis. The requests now made by the Association of American Universities are prompted by the same loyalty and devotion.

The committee of the Association of American Universities appointed to formulate and present to the Secretary of War the foregoing requests offers its services in working out the details necessary in creating the privileges asked for, if these privileges are not already provided for by intended interpretation of the new classification of drafted men.

These suggestions are prompted by the following observations:

(a) That there exists a strong popular feeling that the necessity of organizing the National Army with the least possible delay has prevented the application of the principles of selective draft as the public understood them. In general persons engaged in industrial enterprises have been discharged only if engaged in an enterprise contributing directly but not indirectly to the effectiveness of the military establishment. The maintenance of the national interest, other than purely military, does not seem to have been given sufficient weight by the district boards.

(b) That many highly trained professional, scientific men, such as engineers, chemists, physicists, etc., are now privates in the training camps of the National Army. These men could give more efficient service for the conduct of the war if they were assigned or held available for the exercise of such services as they are best fitted for by their training.

(c) That by voluntary enlistment of university men in service for which they are not best fitted the ranks of the educational institutions have already been alarmingly depleted as regards students, teachers and research men. The university men have shown the highest type of patriotism irrespective of their own interests and have probably responded to the call of the country more enthusiastically than any other class of men. There is immediate danger that without specific provision to the contrary the universities will lack the teachers and students necessary to provide the army and navy with the highly trained men who will be required for the successful conclusion of the war.

It is respectfully urged that professional students be instructed to enlist in the reserve corps of the various branches of the service, with the privilege of furlough for the completion of their training similar to that adopted to secure the most efficient service of medical men.

It is also suggested that only men of proved ability be given this opportunity. Students, teachers and research men should be given the opportunity of enlistment with the privilege of furlough or discharge only subject to the recommendations of the presidents of the institutions concerned. For others the decision should rest with the authorities designated by the Secretary of War.

A telegram on the same subject sent by John W. Lieb, president National Electric Light Association, to Dr.

George F. Swain, Massachusetts Institute of Technology, reads:

It is most urgent that the selective draft provisions should be so construed by the government that engineering and medical students at colleges and professional schools be allowed to finish their courses before being called for active military service. There is already a serious lack of technical men to do urgent government work and the public utilities of the country find it difficult to further deplete their already inadequate engineering staffs to meet the pressing needs of the various government departments for technically trained men.

The men from the public utilties have responded enthusiastically to the call of the nation, and these industries now find it impossible to fill their places and maintain a sufficient force to conduct their enterprises so as to respond to the rapidly increasing demands for heat, light and power to operate industries indispensable in the conduct of the war.

THE ACTIVITIES OF WAR INDUSTRIES DEPARTMENTS

Editors of Business Papers Hear Washington Leaders on Different Phases of the Government's War Program

The seriousness of the present government situation and the necessity for co-ordinated action at Washington were clearly indicated at the second editorial conference of business papers held at the New Willard Hotel in Washington on Dec. 13. This meeting was called in order that the business papers of the country might get first-hand from the makers of news details of the government war activities and such plans as were ready to be announced. In this way it is hoped that the business papers, through a sympathetic interest in the war activities of all of the different departments at Washington, may co-operate better with the government in the waging of a successful conflict.

In opening the meeting, F. W. Taussig, chairman of the United States Tariff Board, was careful to explain the exact status of the board and the scope of its operations. This board, he pointed out, was organized for the purpose of sifting and preparing information upon which Congress shall act. The board itself does not act on the various questions.

Of particular interest to the electrical industry was the address by Dr. Harry A. Garfield, Fuel Administrator.

Speaking of coal supply for utilities, Dr. Garfield said that the utilities should notify the state fuel administrator of their needs. The state administrator will then take the matter up with the federal administrator, who will send priority orders to certain mines to take care of that utility's supply. The utilities, however, should not wait until the last moment, but should put in their requisition far enough ahead to allow ample time for fulfillment. Dr. Garfield said that he was disappointed in the results of fuel saving from the curtailment of sign lighting. He thinks that less was saved than was anticipated and for that reason will change the order. (See ELECTRICAL WORLD, Dec. 15, page 1159.) The difficulty, he stated, was in cutting out the large display signs and therefore the general effect of curtailment was not very great; in fact, only certain kinds were missed. He stated quite emphatically that he did not intend to give up the idea of saving fuel through "white-way" lighting curtailment. He stated that undoubtedly prices have played a part in keeping production from being greater, but he stated that he was unable to prove this, for in fact proof lay in the other direction.

J. B. A. Morrow, secretary of the National Coal Association, told of the extent to which transportation was handicapping the country in the matter of fuel supply. Transportation, he said, was the primary cause of trouble. Furthermore, he pointed out, no effective action has been taken to relieve the situation up to date, and matters are hourly growing worse. There are now at the disposal of the operators about 350,000 cars, and for a short time, he believed, there should be 20 per cent additional.

In pointing out the condition that railroads now find themselves in, Senator Francis G. Newlands, chairman of the joint Congressional committee on interstate commerce, emphatically stated that the roads should have constructive legislation and not so much punitive and correctional legislation as in the past. Pre-war economies in roiling stock, etc., he believed, have resulted in the high cost of living and the high cost of the war, although, of course, they are not the whole cause, but the underlying one. The difficulty of the day is in meeting capital requirements. The relief from this must not come necessarily from rates. Senator Newlands stated that the government may either loan or purchase railroad equipment, and in the latter case lease it to the road.

The present status of the automobile truck industry was shown by Mr. Horning, chairman of the automotive section of the Council of National Defense. He was of the opinion that by cutting out short hauls and substituting therefor motor truck transportation the transportation problem would be solved.

A. W. Shaw, chairman of the commercial economy committee of the Council of National Defense, left with the meeting the thought that by standardizing output, less stock will have to be carried, thereby conserving both capital and raw materials.

Dr. Anna Howard Shaw, chairman of the women's committee of the Council of National Defense, pointed out very clearly the physiological and psychological status of women in the war.

C. A. Richards, chief of the Bureau of Exports, stated that no general embargoes are being issued.

ADVERTISING MATERIAL FOR THE ELECTRICAL CHRISTMAS

Society of Electrical Development Reports Success of Its Campaign for the Giving of Practical Gifts in the War Year

Returns indicate the success of the nation-wide "America's Electrical Christmas" campaign conducted under the general direction of the Society for Electrical Development, according to a report from the society.

Material supplied included 13,000 campaign announcements, 13,000 copies "November Sales Service," containing holiday sales suggestions; 5332 window posters, 5077 window cards, 2500 sets of price cards, sixteen to a set, or a total of 40,000 cards; 2082 door wreaths, 228,000 poster stamps, 200,000 suggestion folders and 36,000 circular letters. The campaign also resulted in many new members. Over thirty have joined the society within the last five weeks.

CALIFORNIA COMMITTEE ON INDUCTIVE INTERFERENCE

Final Report Is Issued After Five-Year Investigation Under Auspices of California Railroad Commission

With the presentation of its final report, dated Sept. 28, 1917, the joint committee on inductive interference, which has been investigating for the past five years, under the auspices of the California Railroad Commission, the disturbances in communication circuits caused by induction from neighboring power circuits, announces the conclusion of its work.

A preliminary report was rendered by the committee in 1914. Besides a discussion of technical features of the problem, rules were recommended to the California commission to regulate the practices of companies operating power and communication lines in proximity to each other. These recommendations were embodied in General Order No. 39 of the commission, which has been in force since August, 1914.

The final report, just issued and based on more extensive investigations conducted since 1914, includes:

1. A historical sketch regarding the formation, personnel, organization, investigations and finances of the committee.

2. A review of the basic principles, comprising a simple statement of the nature of the subject, a summary of the facts established or agreed upon and a concise statement of the guiding principles for the prevention of interference.

3. Recommendations for revised rules to govern the design, construction and operation of power and communication lines and associated apparatus, to prevent or mitigate inductive interference, followed by explanatory comments.

The new rules mark a considerable advance both in substance and form as compared with the 1914 rules. The principle of co-operation in determining means for avoidance or mitigation of interference is emphasized, in conjunction with definite guiding rules where such are practicable. Certain precautionary measures are made applicable to all new construction. The principle of employing the remedial measure involving least total cost for a given benefit, irrespective of whose plant is changed, is declared. The arrangement of the rules has been entirely changed. A detailed summary of the recommended rules is given below.

An exhibit accompanying the rules discusses the arrangement and spacing of power conductors.

4. Five appendices complete the report, dealing with:

1. Interference not covered by the recommended rules, which apply to constant-potential alternating-current power circuits of over 5000 volts between wires, or 2900 volts to ground, and exclude telephone subscribers' loops.
2. List of technical reports prepared by the committee as a record of its investigations.
3. Comments on the 1914 report.
4. A bibliography.
5. A chart showing the organization of the committee.

The detailed record of the investigations of the committee is contained in a series of seventy-one technical reports. Thirty of the reports have been selected as being of sufficient general interest to warrant publication along with the two reports of the committee to the California Railroad Commission. The reports include not only records of tests and their analyses but give the methods of working, theoretical discussions, forms for systematizing experimental and theoretical work and data of general usefulness in predetermining the magnitude of induction to be expected under given conditions and in prescribing remedial measures. All these reports are on file at the offices of the Railroad Commission in California, but unless they are published the valuable information they contain will not be generally accessible. Their publication, however, is contingent upon the receipt of a sufficient number of orders substantially to defray the cost of printing and binding. All persons who are interested in procuring a copy of this publication are requested to notify Richard Sachse, chief engineer, Railroad Commission of California, 833 Market Street, San Francisco.

Conditions of proximity of power and communication lines that cause inductive interference are designated by the joint committee as "parallels."

In preparing the final report a large amount of study was given to the question of determining the conditions of length, separation, voltage, current, wave shape, balance, conductor arrangement, etc., that would constitute a "parallel." In order to set forth the relations in reasonably simple form, it was necessary to assign definite values to several factors which in practice vary widely in value and which it is usually not feasible to determine in particular cases. It was found that sufficient information was not at hand to satisfy all parties as to the assumptions regarding these factors. The committee feared that a definition of these relations, based on such assumptions, would be used in cases where the assumptions did not apply. Consequently the report does not include such a definition. The record of work done on this complex problem remains, however, of great value as indicating the general method of attacking the problem, the difficulties to be overcome, and the accomplishment of results up to date.

The report gives the following as the seven "basic physical principles which underlie the rules recommended and which should guide all efforts to prevent inductive interference":

1. Avoidance of close proximity.
2. Elimination or suppression of harmonics.
3. Limitation of residuals.
4. Reduction of intensity of induction by favorable arrangement of conductors.
5. Neutralization of induction by co-ordinated transposition systems.
6. Balancing of metallic communication circuits.
7. High grade construction and care in the operation and maintenance of power circuits.

A brief summary of the recommended rules follows:

The first section, entitled "General Provisions," provides for: (a) Applicability of the rules. Rules on operation and maintenance are to apply throughout; rules for specific parallels, to cases hereafter created; rules not limited to lines involved in a parallel, to new construction, and in the event of reconstruction. (b) Co-operation. (c) Method of remedy involving the least total cost. (d) Existing parallels are to be cared for with due diligence, depending on the seriousness of their effects.

The second section consists wholly of definitions.

The third section, entitled "Location of Lines," requires: (a) Avoidance of parallelism wherever practicable. (b) Advance notice of intention to construct a line which will create a parallel. (c) The distance between parallel lines to be made as great and as uniform as practicable. Where other remedies fail the separation is to be increased. (d)

and (e) Parallels shall be as short and as free from discontinuities as practicable. Unnecessary crossings of highways are to be avoided.

The fourth section, entitled "Design and Construction of Lines," requires: (a) Attention to quality and workmanship to prevent failures causing interference. (b) Consideration of the configuration of power circuits, also the avoidance of excessive spacing, long two-wire branches from three-phase lines and single-wire grounded circuits. (c) Power circuits to be transposed throughout their lengths with barrels of 6 miles to 12 miles, excepting lines under 12.5 kv. with grounded neutrals and certain lines on private rights-of-way; existing power circuits are to be transposed outside parallels hereafter created when necessary for capacitance balance, with regard to discontinuities. (d) Inside parallels. An adequate transposition scheme, consisting of co-ordinated transpositions in the power and communication lines, if the latter are metallic, to be installed, as determined by co-operative study. In general, at least one barrel shall be placed in the power circuit. At highway separations from telephone lines 3-mile barrels should ordinarily be employed. For parallels with telegraph lines 6-mile barrels are ordinarily sufficient. The most economical scheme and utilization of existing transpositions are to be considered.

The fifth section, entitled "Design, Construction and Arrangement of Apparatus," provides: (a) Quality and arrangement of apparatus to minimize interference. (b) Rotating machinery should have good wave form. Grounds on generators are to be avoided unless the arrangements are such as to avoid unbalancing the circuit and introducing residuals. (c) Transformer exciting currents should be as low as is consistent with good practice (for most cases less than 10 per cent at normal voltage). Grounded single-phase, grounded three-wire two-phase and grounded open-star three-phase connections are prohibited. Star-connected auto-transformers with grounded neutrals on three-phase lines in parallels must also have low-impedance, delta-connected windings or other equivalent means of suppressing triple harmonic residuals. (d) Auxiliary devices to prevent distortion of the waves by rectifiers, etc., are to be installed where necessary. (e) One oil switch with poles mechanically interconnected for simultaneous operation is required between a parallel and the source of supply of the power line to operate automatically in case of abnormal conditions, except where an operator is on duty. Consideration is to be given to switching arrangements to minimize transients. Where air-break or single-pole oil switches cause trouble oil switches with poles interconnected are to be used. (f) Fuses are to be avoided for main lines in parallels. (g) Electrolytic lightning arresters are to be equipped to minimize their disturbing effects. (h) Indicating devices are to be provided at supply stations to give warning of abnormal conditions, and ammeters are to be installed in important neutral-ground connections. (i) Apparatus for metallic communication circuits is to be well balanced.

The sixth and last section, entitled "Operation and Maintenance," requires: (a) All reasonable care by power and communication interests to minimize interference and, in particular, (b) prevention of mechanical and electrical failures which would cause or promote transient disturbances and unbalanced loads. (c) Daily record of current in grounded neutrals of important stations. (d) Transformers are not to be operated at more than specified percentages above normal voltage. (e) Care shall be exercised to avoid switching disturbances. (f) Where lightning-arrester charging disturbs it should be done in the early morning. (g) A definite procedure shall be provided for station operators during times of abnormal unbalance on power lines involved in parallels. In general, the section of a faulty line passing a parallel should be disconnected until cleared and not energized more than once in locating the fault. To facilitate the study of such cases, accurate records are to be kept of occurrences under abnormal conditions.

The entire work of the joint committee on inductive interference constitutes a notable example of the efficiency of co-operative work of engineers representing conflicting interests in lieu of methods of litigation based upon meager information concerning the underlying principles and facts of a complex problem. As perhaps the chief result of this effort on the part of the joint committee, there has been created in the State of California a realization of the seriousness of inductive interference, an understanding of practical preventive and remedial measures, and, most important of all, a disposition on the part of the power and communication companies to co-operate in the solution of the problems which arise from the construction of the two classes of lines in proximity.

That the work of the joint committee is fully appreciated by the California Railroad Commission is evident from a letter written by the commission to the members of the committee, in which it says:

"In receiving this final report and in accepting the resignations of the members of the joint committee, we desire to express to each member of the committee our very sincere appreciation of the splendid work which the joint committee has done during the last five years. The work in its complete form is a monument to this committee of which each member must be justly proud."

CHANGES SUGGESTED AT POWER TEST CODE HEARING

Recommendation for Appointment of Sub-committees to Revise Each Section in Co-operation with Those Who Would Be Most Affected by Change

Numerous suggestions and recommendations were made at the public hearing held recently by the power test code committee of the American Society of Mechanical Engineers in New York. Taken as a whole these would mean the complete rewriting or revision of the existing power test code.

As a result, a motion was passed recommending to the council that sub-committees be appointed to revise each section of the code, reporting to the present power test code committee, which will then co-ordinate the work of the individual sub-committees. It was also recommended that the members of the sub-committees be representative of purchasers, manufacturers and impartial persons, and that they co-operate with the national societies or associations most vitally interested in the section of the code represented. It is intended that the new power test code shall cover all mechanical power-plant apparatus.

The section of the code which seemed to be most objectionable refers to waterwheel testing. To give the sub-committees some basis to work on in revising the waterwheel section of the code it was recommended by a unanimous vote that the Machinery Builders' Society code be considered, as it represents the best waterwheel acceptance test available at present. This subject was also discussed in New York at a closed session by a joint committee representing the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Society of Civil Engineers, it being the purpose so to reword and revise this section that manufacturers of waterwheels would have a definite basis on which to work and that waterwheel users would have proper protection assured by standard acceptance tests.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Ordinance Too Imperfect to Be Investigated.—The Ohio Public Utilities Commission announced on Dec. 13 that the investigation of the electric light rate case originating in Ottawa and appealed by the Northwestern Ohio Light Company had been discontinued because the ordinance attempting to fix the rates contained "so many infirmities" that it was not justified in spending the State's money or putting the company and the town to the expense of employing experts when the ordinance could be set aside.

New Rates Authorized for Calistoga, Cal.—The Calistoga Electric Company has been authorized by the Railroad Commission of California to establish a new schedule of rates for electric service, with a monthly meter consumption basis of 10 cents per kilowatt-hour for the first 100 kw.-hr., 5 cents per kilowatt-hour for all over 100 kw.-hr., and a minimum monthly charge of $1 per meter. Power rates and municipal lighting rates are also fixed by the commission. These new rates are expected to bring the company an increase of little more than 10 per cent in gross revenue and to result in a net return on the company's total investment of approximately 4½ per cent. The company distributes electric energy for light and power purposes in Calistoga and surrounding suburban territory in Napa County, serving 317 consumers. Its energy is purchased from the Napa Valley Electric Company at Bale Station.

"Reasonable" Service.—In a case affecting the Mineral Point Public Service Company the Wisconsin Railroad Commission holds on "reasonable service": "That the term 'reasonable service' as used in the statute not only refers to a sufficient supply of power at the present moment, but also to the reasonable assurance of such supply in the future, and that the service afforded by respondent is inadequate, in that insufficient provision is made for a continuous supply of current under emergency conditions; that the necessity for continuous operation of the mines served by respondent is of great importance; that an extended interruption of power service in the case of a mine results in various serious losses, but that in the case of those here involved the welfare of the community, and perhaps the public in a much larger sense, also depends upon the successful and efficient operation of the mining industry; that the determination of what provision should be made to assure continuous service under emergency conditions is properly a function of the utility, however, with which the commission does not wish to interfere, but will pass upon with reference to its adequacy for compliance with the order when decided on."

Time Allowed for Reconstruction Because of Higher Costs.—Because of higher costs, the California Railroad Commission has extended the time within which certain utilities may reconstruct systems to comply with laws regulating standardization of electric pole lines, as follows: Southern Sierras Power Company to complete one-third of its reconstruction work before Dec. 31, 1917, two-thirds before Dec. 31, 1918, and the entire work before June 30, 1919; Bishop Light & Power Company to complete one-half of its reconstruction work before Dec. 31, 1917, and the entire work before June 30, 1918; Corona Gas & Electric Company to complete its entire work before Dec. 31, 1917; Rialto Light, Water & Power Company to complete its entire reconstruction work before Dec. 31, 1917; Holton Power Company to complete at least one-half of its reconstruction work before Dec. 31, 1917, and its entire work before Dec. 31, 1918.

National Crisis Calls for Ultra-Conservatism.—A decision of the Oklahoma Corporation Commission holds that the St. Louis & San Francisco Railroad Company and Kansas City, Mexico & Orient Railway are not required to make a physical connection at a certain point because war-time conditions supersede in importance all other conditions. The commission says: "The foregoing considerations appear to the commission to be conclusive as to the merit of the application herein. However, there are certain special considerations operating at this time which emphasize the necessity for and correctness of the decision indicated. Crop conditions in Oklahoma, especially in the section through which the defendant Kansas City, Mexico & Orient Railway Company's line operates, are exceedingly discouraging, and railroad earnings in this section of the State this year, compared with normal years, indicate that the roads should forgo all except the most imperative expenditures. Railroad material, like that used in any sort of construction, is higher in cost than for years, in many instances higher than ever, and sound judgment decrees that projects involving expenditure for such material should be deferred where possible. Furthermore, the national crisis, calling for ultra-conservatism in all directions, demands universal co-operation to the end that the resources of the country, both physical and financial, shall be applied as exclusively as possible to projects contributing directly to the effective prosecution of the war in which the country is involved. The commission, being fully advised in the premises and having given full and careful consideration to all the facts submitted on both sides of the case, finds that the evidence in support of the application is insufficient to sustain the case, and the case is dismissed. Should business conditions change a new case at such time may be heard."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Water Rights of Subsequent Grantee.—Where plaintiff city had secured all the title of the owner of the fee to the water of the stream which was to be used for domestic and other purposes, the impounding of water for use in developing electricity by defendant, which had secured the remaining right from the grantor, was an interference with a substantial right justifying an injunction, although the water impounded by defendant was emptied back into the stream above the city's intake pipe, the use tending to pollute the water, and being an open and adverse use which would ripen into title if acquiesced in, the Supreme Court of Washington held (167, P. 914) in City of Raymond versus Willapa Power Company. The court stated that it knew judicially that modern science has demonstrated that the use of water in power plants and for other purposes where human beings must of necessity be in attendance seriously endangers its purity, rendering it unfit for human consumption.

Responsibility to Employees in Municipal Plant.—Deceased was employed by defendant as first engineer of its electric light plant, which position virtually carried with it control and management of its plant. While so employed it was his duty to work at and near two tube tanks and the arc-light switchboard. These tube tanks were about 18 in. square, placed side by side. The arc-light switchboard was about 15 in. to the nearest tank and had projecting 8 in. or 10 in. from the west side of it two electrodes, carrying constantly 2300 volts of electricity, which furnished the energy for defendant's arc lights. A wire, uninsulated, and the metal clips on top of these electrodes, which were unguarded, ran underneath these electrodes. On the west side of the building was a washbasin. It was deceased's duty to remove the tubes from these tube tanks daily and carry them to the washbasin and wash them, after which, he replaced them in the tanks. It was while he was performing this duty that he came in contact with the electrodes and received a shock of 2300 volts of electricity, which a few days thereafter resulted in his death. The Supreme Court of Oklahoma in City of Durant versus Allen held (168 P. 205) that defendant in operating its electric plant assumed the same responsibilities to its employees therein as are assumed by private persons and private corporations operating similar plants; that, owing to the highly destructive agency in the manufacture of which defendant was engaged, it was held to a correspondingly high degree of care and foresight.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

United States Independent Telephone Association.—At a meeting of the board of directors of the United States Independent Telephone Association held at the Hotel LaSalle, Chicago, Nov. 17, it was unanimously decided to hold the annual convention at the Hotel LaSalle on June 25 to June 28, 1918.

Pittsburgh Section, I. S. E. E.—The January meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers will be a joint session with the American Institute of Electrical Engineers. Papers will be presented on generation, distribution and consumption of power, as well as one dealing with power-factor correction.

Association of Iron and Steel Electrical Engineers.—The regular monthly meeting of this association was held at the Hotel Chatham (old Hotel Lincoln), Penn Avenue, Pittsburgh, Pa., on Dec. 15. A brand-new subject, "Flywheels on Steel-Mill Motors," which is of current interest to every steel-mill electrical engineer, was presented by G. E. Stoltz of the Westinghouse Electric & Manufacturing Company.

Illuminating Engineering Society.—The Pittsburgh Section of the Illuminating Engineering Society held an all-day meeting at the Electrical League rooms in the Statler Hotel, Cleveland, Dec. 14. The program follows: Remarks by G. H. Stickney, president I. E. S.; "The Illumination of Offices," by Ward Harrison and J. R. Colville; "The Foot-Candle Meter," by C. F. Sackwitz; informal discussion of the new industrial lighting code for Ohio; "Preferred Proportions in Combining General and Localized Lighting," by F. C. Caldwell and W. M. Holmes; notes on the use of the searchlight by R. B. Chillas; some aspects of light, shade and color of timely interest by M. Luckiesh of the National Lamp Works of the General Electric Company.

San Francisco Electrical Development and Jovian League.—At the Dec. 5 meeting of this organization R. H. Ballard, Southern California Edison Company, spoke of the new movement now manifesting itself in various branches of the electrical industry on the Pacific Coast toward "The Greater Organization." This is simply another name, he said, for more effective co-operation of manufacturers, central stations, jobbers and dealers and contractors. Capt. H. F. Jackson, Sierra & San Francisco Power Company, outlined the co-operative campaign now being carried to success, in which the various branches of the industry have combined for a year's educational work aimed toward better business. Other speakers whose talks were along similar lines were Emory Wishon, San Joaquin Light & Power Company; H. C. Reid, president California Association Electrical Contractors and Dealers; K. E. Van Kuran, Los Angeles district manager Westinghouse Electric & Manufacturing Company; Harry Bostwick, Pacific Gas & Electric Company; W. W. Briggs, Great Western Power Company; Dave Harris, Pacific States Electric Company, and J. E. Woodbridge, Sierra & San Francisco Power Company.

Chicago Section, A. I. E. E., Meetings.—Some changes in the program of the Chicago Section of the American Institute of Electrical Engineers for its winter meetings have been made since the tentative program was published. The program in its final form is as follows: Major Robert A. Millikan, vice-chairman and executive officer Research Council, on "The Relation of Science and Engineering to the War," Dec. 27 (luncheon meeting at Hotel Sherman jointly with Electric Club-Jovian League); three hundred and thirty-sixth meeting of the A. I. E. E., held as a part of the activities of the committee on economics of electric service, the speakers, Lynn S. Goodman and William B. Jackson, dealing with "The Effects of War Conditions on the Cost and Quality of Electric Service," Jan. 14, 1918; Thaddeus Baily and John A. Seede on "Resistance-Type Furnaces" and "Arc Furnaces and Their Application," on Feb. 25; Charles F. Burgess, "Electrochemical Processes," March 25; mechanical section meeting April 22, subject to be announced later, and Frank A. Vaughn, "Regulation of Street Series Lamps," May 27.

Army Day at Chicago Electric Club-Jovian League.—Army mess served in army kits with the meal superintended by a former club member—Sergeant William L. Geuder from Camp Grant—was the feature of the program of the Electric Club-Jovian League meeting, Dec. 13. Joseph Byfield, proprietor of the Hotel Sherman and one of the speakers, told how he had assisted in training 2800 civilian cooks for the army. A service flag which Mrs. L. C. Spake made for the club was presented by Frederic P. Vose. After an appeal for contributions to the Knights of Columbus recreation camp fund F. W. Harvey took a collection amounting to $135. This was followed by another collection made in army coffeepots and amounting to $159.65 to purchase recreation equipment for Battery D, 332d Field Artillery, of which Sergeant Geuder is a member. On account of the fact that Dec. 13 was election day for the club and because of the unusual program, the meeting was one of the largest in the club's history, more than 325 being present. The election resulted in a complete victory for the regular ticket by very narrow majorities. The new officers are: President, Fred M. Rosseland; first vice-president, E. A. Rummler; second vice-president, Harry A. Porter; secretary, W. H. Hodge; trustees, Paul W. Koch and Arthur P. Nelson.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Date for Hearing Cleveland Rate Case.—The Ohio Public Utilities Commission has fixed Jan. 3, 1918, for hearing the Cleveland rate case. Some time ago the valuation was announced and a rehearing was refused on this phase of the case.

Women in Lamp Sales Department.—The shortage of male help in Kansas City's electrical industries, both light and power and street railway, became acute with the first of December, when the enlistment of many young men in the ordnance division of the army took place. As a result the Kansas City Light & Power Company placed girls in its lamp sales department. The company selected a standard uniform of light brown slip-over apron with white collar for these saleswomen. The service has been kept up to standard with the use of one more saleswoman than there had been salesmen. Girl stenographers and bookkeepers have supplanted the younger men.

Electrical Show at Lafayette College.—The Lafayette College branch of the American Institute of Electrical Engineers, in conjunction with the electrical department of the college, held an electrical show on Dec. 13, 14 and 15 in the college buildings at Easton, Pa. During the show illustrated lectures were given on the progress of electricity, the wiring of homes, and household appliances. Moving pictures were also shown, lectures and films being loaned by the General Electric Company. The chief feature was a series of experiments with a Tesla coil which were conducted by members of the senior class. A lamp was lighted through the body, corona effects were shown, and several insulators were punctured. Of special interest to women was the complete exhibition of household electrical appliances. For the engineer there was the industrial exhibit, which contained single-phase, two-phase, three-phase, alternating-current and series, shunt and compound direct-current power motors, starters, transformers and many other commercial appliances. William L. Lipps, a member of the senior class in electrical engineering at Lafayette and also the local secretary of the Lafayette College branch of the A. I. E. E., had charge of the show. He was helped by Dr. Rood, who is in charge of the electrical department at Lafayette. In the actual laying out of the exhibits he was greatly assisted by Professor Tanzer of the electrical department and Mr. Hartung of the senior class. Others who helped were Messrs. Britton, Riegel, Williams and Hagey of the senior class and Messrs. Ross and Cook of the junior class.

P. H. Chase, who was assistant engineer with the Public Service Electric Company, Newark, N. J., has become electrical engineer of the American Railways Company, with headquarters at Philadelphia, Pa.

Gerard Swope, vice-president and general sales manager of the Western Electric Company, has just returned from an extended tour of the East, where he has been studying markets and general conditions.

L. R. Coffin, manager of the Whatcom County division of the Puget Sound Traction, Light & Power Company, Bellingham, Wash., has been ordered to report for duty at the American International Shipbuilding Company's office, Philadelphia. Mr. Coffin has been manager at Bellingham since 1910.

H. W. Asire has been appointed research assistant for the engineering experiment station of Purdue University. Mr. Asire is a graduate of Purdue University, class of 1914, School of Electrical Engineering. Since graduation he has been engaged in research development work for the Quick Action Ignition, South Bend, Ind. For the present he will devote his time to investigation and research along special lines being developed by the schools of electrical and mechanical engineering.

J. C. Martin has resigned as chief engineer of the Pacific Power & Light Company to become connected with the Lehigh Securities Corporation at Allentown, Pa. Mr. Martin joined the Pacific Power & Light Company in the early days of the organization. He is widely known on the Pacific Coast for his association work. For two years he was chairman of the technical and hydroelectric committee of the Northwest Electric Light & Power Association. His work in committees of this association along the lines of proper rules for overhead-line construction and telephone inductive interference was also particularly noticeable.

Charles H. Parker has been appointed superintendent of the generating department of the Edison Electric Illuminating Company of Boston, succeeding the late William P. Hancock. Mr. Parker entered the employ of the company late in 1895 in the generating department in charge of steam testing. In the summer of 1900 he was appointed assistant superintendent of the generating department, continuing in that work until his present promotion. He holds membership in a number of engineering and technical societies and has had a wide experience in the Massachusetts Naval Battalion. He retired from the battalion in 1904 as a lieutenant-commander. In 1908 he was appointed engineer member of the Naval Bureau at the Massachusetts State House with rank of commander, retiring four years later with the rank of captain. Since the United States' participation in the war Mr. Parker has served on the Massachusetts Public Safety Committee as a member of the naval committee and has been appointed acting chief of the department of naval militia.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Frank L. Dame has been elected president of the Central States Electric Corporation. Prior to becoming connected with the Harrison Williams organization, which manages and directs the Central States company, Mr. Dame was vice-president of the Electric Bond & Share Company, in charge of its operating department. He is a graduate of the Massachusetts Institute of Technology. His early connections in the industry were with the General Electric Company in the Pacific Northwest. Later he became general manager of the Union Electric Company of Dubuque, Iowa, after which he was appointed engineer for the Electrical Securities Corporation shortly after its formation in 1904. He continued in that position until his election as a vice-president of the Electric Bond & Share Company in the fall of 1909.

F. L. DAME

Leonard S. Cairns, assistant general manager of the Manila Electric Railroad & Light Company, Manila, P. I., has been appointed general manager of the Eastern Pennsylvania Railways Company, Pottsville, Pa., by the J. G. White Management Corporation, New York City, the operating manager of both companies. Mr. Cairns has arrived in the United States and has assumed the duties of his new position. He succeeds L. H. Palmer, who lately became assistant to the president of the United Railways & Electric Company, Baltimore, as lately announced in these columns. Mr. Cairns upon leaving high school entered the employ of the Twin City Rapid Transit Company, Minneapolis, and, after several promotions, was made general superintendent of that company. In 1912 he was appointed assistant general manager of the Manila company.

Obituary

James McElroy, connected for the last few years with the municipal power plant at Orange, N. J., in the capacity of engineer, died Dec. 8 at his home in that city.

William F. Sonn, who since the early days of the lighting industry has been in the employ of the Edison Electric Illuminating Company of Boston and its predecessors, died at his home in Boston on Dec. 4 at the age of fifty-six years. In 1883 and 1884 he was assistant to William J. Hammer, the chief engineer of the German Edison company at Berlin, later assisting Mr. Hammer, in 1886 and 1887, when he was manager and chief engineer of the lighting company at Boston. In 1889 he accompanied Mr. Hammer to Paris, where the latter represented Mr. Edison at the Paris Exposition. Mr. Sonn assisted in the installation of the first electric lighting plant not only in Berlin but also in Wilmington, Del.; Chicago, Ill., and Grand Rapids, Mich.

William Du Bois Duddell, originator of the Duddell oscillograph and well known for his contributions to electrical engineering research both in alternating-current phenomena and radio-telegraphy, died recently in England at the age of forty-five years. In 1898 he brought his oscillograph to the attention of the engineering profession in a paper prepared in conjunction with Dr. Marchant, entitled "Experiments in Alternating-Current Arcs by Aid of Oscillographs." In his research Mr. Duddell showed his mechanical ingenuity by designing and constructing special new and delicate instruments entirely of his own handiwork. Among other papers presented by him which have caused worldwide comment are "Rapid Variations of Currents Through the Direct-Current Arc" and "The Resistance and Emfs. of the Electric Arc." In radio work his activity dated from the early days of the science. He determined the law, since confirmed and extended by Dr. Austin, connecting distance and the strength of received signals. He was appointed in 1912 by the English government a member of the technical committee for the consideration of long-distance wireless telegraphy and subsequently was appointed consulting engineer to the English Post Office in connection with the imperial wireless contract. In April, 1915, he presided in Brussels over the international commission to aid radio research. Mr. Duddell, who was one of the younger men in the industry, had the distinction of being the first to hold the position of president of the British Institution of Electrical Engineers. This was in 1912-14. He occupied many other positions of honor in connection with his activities in the field of electricity. In addition, Mr. Duddell was a fellow of the Royal Society of England.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MEANING OF TRANSPORTATION PRIORITY ORDER NO. 5

No "House That Jack Built" Materials of Manufacture Are Permitted Under Latest Government Order

Some confusion has arisen in the trades over the exact meaning and application of Priority Order No. 5, issued by Judge R. S. Lovett's committee. This order provides for five different classes of transportation priority and went into effect on Dec. 12. The order gives preference in car supply and movement, (1) to coal for current use of railroads, (2) to food and perishable freight, (3) to military supplies and government shipbuilding material, (4) to coal for by-product coking plants, and (5) to coal for domestic and institutional purposes and to coal and raw materials for blast furnaces, foundries, iron and steel mills, smelters, manufacturers engaged in work for the government or its allies, public utilities, flour mills, sugar factories, fertilizer plants and shipbuilders, besides shipments of paper, petroleum and petroleum products.

These priorities are now automatic, and any manufacturer by satisfying the local railroad agent that his products come under one of the five heads can secure, if at all available, quick and adequate transportation of his goods. The railroads can issue no embargoes on any of the items enumerated in Order No. 5 unless the matter is first taken up with the priorities commission and approved.

To a representative of the ELECTRICAL WORLD it was stated last week in Washington that the committee on priorities believed it to be particularly important that manufacturers understand clearly the intended meaning of Section 5 of the order. The order says for "raw materials for current use but not for storage consigned direct . . . to manufacturers engaged in work for the United States government or its allies, public utilities," etc. By "raw materials" is meant any thing necessary to the manufacture of the finished product.

It was definitely stated that the order was not meant to include those products which enter into the manufacture of what the order calls "raw materials." Thus a manufacturer of gasoline-driven generator sets for field searchlights could expect priority shipments of electrical generators. On the other hand, the generator manufacturer could not, on the basis of this contract, under Priority Order No. 5, expect priority transportation of his raw materials. What the committee has tried to accomplish in this connection is to eliminate the "house that Jack built" class of priorities.

Shipments under the five classes listed take up, it is understood, about 50 per cent of available transportation. The remaining facilities are at the disposal of all other commodities in accordance with the roads' designations.

LIST OF BRANCH OFFICES OF THE WAR TRADE BOARD

Established in Nine of the Principal Cities in Various Parts of the Country—Officials Who Are in Charge

Following is a list of the branch offices of the War Trade Board, which has jurisdiction over licensing of goods for export and also in the administration of the enemy trading act: Galveston, Tex., George W. Briggs, special agent, bureau of exports, Federal Building; Los Angeles, Cal., William Dunkerley, special agent, bureau of exports, custom house; Mobile, Ala., M. Waring Harrison, special agent, bureau of exports, custom house; New Orleans, La., Joseph P. Henican, special agent, bureau of exports, Canal Bank Building; New York, N. Y., W. E. Peck, special agent, bureau of exports, 11 Broadway; Portland, Ore., Henry L. Corbett, special agent, bureau of exports, 748 Morgan Building; San Francisco, Cal., C. O. G. Miller, special agent, bureau of exports, custom house; Savannah, Ga., J. W. Motte, special agent, bureau of exports, Savannah Bank and Trust Company Building; Seattle, Wash., J. MacPhee, Ferguson, special agent, bureau of exports, care of Bureau of Foreign and Domestic Commerce.

The following are branch offices of the Bureau of Foreign and Domestic Commerce which co-operate with the War Trade Broad: Boston, Mass., Ansel R. Clark, special agent, care of Bureau of Foreign and Domestic Commerce, custom house; Chicago, Ill., George W. Doonan, special agent, care of Bureau of Foreign and Domestic Commerce, Federal Building; St. Louis, Mo., Paul M. La Rose, special agent, care of Bureau of Foreign and Domestic Commerce, 402 Third National Bank Building.

REASONS WHY ELECTRICAL GOODS ARE NOT HIGHER

Economies in Manufacture Due to Waste Elimination, Quantity Production and Modern Apparatus Help Prevent Prices Rising

That electrical supplies have not advanced to the same extent that basic materials and labor have increased is now well known and is often wondered at. The fact is not due entirely to any one cause but to a number of causes all of which tend toward one end—economy of production.

It probably costs considerably more to sell to-day than it did formerly because of the heavy extras and special methods. Production costs per unit of output, however, have not risen so fast. For one thing, quantity production has helped to hold down unit costs; also, new methods and machinery have been devised to decrease labor costs. Utilization of what was formerly called waste is a third factor. It is doubtful whether the saving in this latter matter would formerly have been profitable or sufficiently so to warrant any great activity in that direction. Now it is different.

To illustrate, a well-known electrical manufacturing concern specializing in motors is adopting every means by which the waste involved in its factory operations may be cut down and is having results. Recently a laundry was established in one of its plants and several hundred pounds of rags are put through weekly. Under the old plan rags were purchased at 6 cents and 7 cents a pound, used until saturated with grease, and then burned. About 2000 lb. of rags and cotton waste per month were destroyed in this manner. Under the present arrangement new rags, consisting of mill ends and ends of made-up toweling, are bought for 20 cents a pound. A minimum of twelve washings brings the price per pound, as compared with the old method of buying, down to 1½ cents.

Economy in the use of lubricating oils is considered, also the extraction of oil from metal chips and shavings. Oil used for cooling the cutting tools and lubricating the work of the new machines and lathes when renewed represents a saving. The present oil bill of the company is about one-third of what it would be if the oil were permitted to waste.

A saving in the use of mica insulation, through the method of punching, is brought about by a rearrangement of the dies. A similar economy in metals has been accomplished through the use of a double die, by means of which an armature disk and the center of an alternating-current field are punched out at the same time.

Still another saving is made in connection with the department for the cleaning of belting which has been rendered ineffective through becoming coated with oil and hardened, and repair work has been extended to utilize scrap belting by cementing pieces of belting as short as one foot. It has been found worth while.

RAPIDLY GROWING MARKET FOR ELECTRIC FURNACES

A Number of Patents Have Been Issued Recently for New Systems, Many of Which Have Been Placed on the Market

Within the past year the market for electric furnaces has noticeably expanded. In that time the number of different makes has more than doubled. Three new makes have been announced as ready for the market within the past few weeks, and patents for furnaces are being issued in greatly increased numbers. While the steel mills are utilizing many more electric furnaces than formerly, the non-ferrous field is rapidly recognizing their value.

The United States Navy in October placed contracts for seven more 6-ton electric furnaces, making eleven purchased recently. This represents a total expenditure of over $500,000. Of the seven just ordered three will be installed at the government plant at Charleston, W. Va., three at the Watertown Arsenal, and one at the Washington Navy Yard.

The Booth Hall Company announced in October three new installations, one 3-ton, one 0.75-ton and one 1.5-ton, while a couple of weeks later the Electric Furnace Construction Company announced an order for one 6-ton, one 1-ton and a special Greaves-Atchells type furnace for ferro-alloys, besides a 2-ton furnace for use in New Zealand and three other furnaces, two of the 3-ton type, which will be used for special aeroplane and motor steels. This latter type is finding a wide use in Great Britain, especially around Sheffield.

METAL MARKET SITUATION

Prices on Copper Remain at the Official Figure—Lead and Brass Decline—Tin Normal

So far as the price of copper goes, while there was a governmental conference on the question last week, no change will be made for the first quarter of 1918. Producers and large consumers are now discussing the year's output, which will be fully 40,000,000 lb. above estimates, official and otherwise. Manufacturers engaged in government work are buying, in car lots and over, the required copper at the government price of 23.50 cents, while at the established jobbing price, 24.67½ cents, a fair business has been done for early shipment. Finished copper-wire products have not fluctuated and stocks are enough for requirements of the trade. Deliveries will probably grow worse rather than better.

No tin is being offered and prices are therefore nominal. Lead will not be subject to government regulation and is reduced a shade, as is brass also.

NEW YORK METAL MARKET PRICES

	Dec. 10	Dec. 17
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00 to 29.00*	27.00 to 29.00
Lead, trust price	6.25	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.67½ to 7.77½	7.67½
Tin, Straits	86.00	80.00†
Aluminum, 98 to 99 per cent.	34.00 to 36.00	34 00 to 36.00

OLD METALS

Heavy copper and wire	22.50 to 23.00	22.00 to 22.50
Brass, heavy	14.50 to 16.00	14.00 to 15.00
Brass, light	10.50 to 11.00	9.50 to 10.50
Lead, heavy	5.75 to 5.87½	5.75 to 5.87½
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal. †None offering.

THE WEEK IN TRADE

NATURALLY with the close proximity of the holidays the sale of seasonable merchandise is not only far in advance of previous records but continues to grow. So far, outside of delays caused by erratic deliveries, stocks are in a strong position to meet demands. Electrical equipment of a miscellaneous kind is moving and is stronger in some sections, particularly where shipbuilding and similar war enterprises are rapidly developing and increasing their output. Shortages of staples are also reported, especially on motors and transformers, carbon lamps, air heaters, etc., with prices stiffening. Reflectors, projectors, fixtures, pipe fittings, insulators, portable lamps and meters are in fairly good supply and selling satisfactorily. Orders to be filled in the new year are getting more in evidence, as it seems impossible to secure prompter shipments. Shortages due to slow freight movements promise to become more acute rather than better. The labor outlook is not altogether bright, but it is improving.

Collections are reported as not needing any harsh criticism; in fact, they are excellent, so much so that jobbers are discounting their bills. Credits are subject to close inspection, which they are receiving.

NEW YORK

General conditions, barring the late deliveries, are reported as quite satisfactory to manufacturers, jobbers and dealers. On the part of the public the purchase of electric specialties, particularly in all household appliances, is attaining new high records. Staples are also moving along, with stocks in fairly good shape. While no price changes of great account have been announced, still some revisions have taken place, with others promising to materialize at the opening of the new year.

Collections continue to hold up, as might be expected under existing circumstances. Credits are carefully looked after, with trade acceptances a subject of discussion as the proper solution of book-account troubles.

FANS.—Following the exclusive announcement in last week's ELECTRICAL WORLD regarding the revised prices and outlook for motor fans in 1918, wagers are being offered that by August the shortage will again be acute. Jobbers and dealers are cautioned by the producers and primary distributers that, so far as can be figured in connection with passing events, too conservative buying is not a safe policy. The best informed jobbers are arranging for representative stocks, larger even than in 1917. Dealers as well as jobbing houses are being advised not to force the sale of fans much in advance of seasonable demands, for obvious reasons.

HOUSEHOLD APPLIANCES.—A price increase in all appliances is regarded as certain around the first of the year. No positive percentage is mentioned as yet, manufacturers contending that material and other conditions fully warrant the revision of the list on a higher level.

COLLECTIONS AND CREDITS.—The settlement of current bills is along satisfactory lines, and little complaint is heard of chronic delinquency. Credits receive close attention.

LAMP BRACKETS.—The supply of lamp brackets is short, with no immediate prospect of improvement. Various causes are responsible for this curtailment, of which the chief is the freight embargoes.

SOCKETS.—With the introduction of a new threaded catch socket, jobbers handling this line are advising dealers to carry a stronger stock of parts, that is ¼-in., ⅜-in. and ½-in. caps, as they are then in better position to take care of requirements. Standard sockets are also in fair supply.

CARBON LAMPS.—The growing general demand for carbon lamps, of which there is a shortage, is a matter of concern to both manufacturers and the distributing trade. It is the belief that a great deal of the educational work which has been done to demonstrate the great advantage in efficiency of the tungsten lamps must be done over again.

PORCELAIN.—In this territory the porcelain situation is greatly improved. The supply is more liberal, but prices are unchanged.

AIR HEATERS.—With the sharp curtailment of coal in New York and environs resulting from the recent heavy snowstorms, the demand for electrical heaters suddenly assumed large proportions. Jobbers are urging manufacturers to expand their facilities, increase the output and better the deliveries to relieve the congested condition. Several hundred are on delivery, even by one jobber, but few are to be had. As soon as received they are allotted to various buyers to satisfy urgent requirements. Prices in a few weeks have gone from $7.50 to $9 each.

CONDUIT.—Conduit is reported as very unsettled. Some quotations are low, to the wonder of the distributing trade in general.

CHICAGO

The volume of business in the Chicago territory continues entirely satisfactory as to totals. Repeatedly, however, there come to the surface facts which reflect the changing character of business and the changing channels of distribution as well as of consumption. Christmas shopping in retail Chicago during the so-called early buying period has not been up to expectations, but with the present snow and cold weather bringing a "feeling" of holidays it is thought that staple gifts at least will leave the shelves in goodly numbers. A tendency along this line is noted in some quarters. Industrial activity is continuing to grow as government contracts filter down through the usual course of handling to the factory which is really to do the work. There have been no material changes in price except in isolated instances wherein the change was dictated by other than the usual competitive considerations. Wire is a little weaker pending the first of January revision of copper prices.

INSULATORS.—After a lull of about two months the market for suspension type units has become active, with inquiries originating from several sections of the country. It is thought that a large part of the business is replacement work. Deliveries of both pin and suspension types are generally on a two months' to three months' basis. Indications are that if present inquiries result in orders, deliveries may go to a six months' basis on account of the fuel shortage in eastern Ohio and western Pennsylvania.

PROJECTORS.—Demand continues better than ever. Shipyards are taking from 100 to 150 units each, and in some factories with large floor area these units are being used for indoor lighting.

FIXTURES.—Indirect-lighting units seem to be the only sort enjoying any sale. One company making this type reports it has all the business it can handle.

WATT-HOUR METERS.—Business is off on account of slack conditions in building lines.

TRANSFORMERS.—Deliveries range all the way from "out of stock" to seven months, depending on whether it is possible to get the raw materials required for a particular design. In general the larger sizes operating at the higher voltages are most difficult to get. Some 75-kw. and 100-kw. units are being shipped out of stock.

MOTORS.—The general situation as regards motor deliveries remains about the same, sizes of 30 hp. and larger being hard to find. There seems, however, to be promise of better conditions.

HIGH-TENSION EQUIPMENT.—It is reported that the demand for pot-heads, cable-end bells, high-tension switches and the like is slackened somewhat, although business is still in a very healthy state.

AIR HEATERS.—On account of the increasing tendency for apartment owners to decrease coal consumption in the interests of both the government and their own pocketbooks the market for heaters to be used in bathrooms, nurseries and bedrooms has been markedly increased.

HEATING DEVICES.—The retail movement of heating devices in the last three weeks has been unsatisfactory in the Chicago territory. With the arrival of a first-class blizzard, however, it is expected that Christmas shopping will begin in a lively fashion and will make up in the last few days in the season what it lacked earlier in volume.

VACUUM CLEANERS.—On account of the fact that central station companies have been reducing stocks of appliances on hand, and especially because they have been shortening the duration of time payments, vacuum-cleaner sales have been somewhat backward in the last few weeks. The general public has not ceased to buy, however, and now that stocks are down to a minimum, a better wholesale movement is expected. This should not be taken to indicate that the vacuum-cleaner business is at all backward in this territory, as taken for the year it is about 100 per cent ahead of last year's business.

BOSTON

Business continues brisk with the advent of the Christmas trade, and while the volume of appliance sales is not expected to reach the total of a year ago, dealers report a healthy demand for all classes of electrical conveniences. A slight recession in industrial wiring contract work is noted, but increasing demands of war service are likely soon to overshadow reductions in general construction. Collections are fair, as last week, and no price changes are announced. Insulating material is getting scarcer. For the moment the labor situation is reported as satisfactory as to supply in widely separated localities occupied by electrical manufacturing plants, but this must be taken as true in individual cases and not as the prevailing condition. An increasing shortage is anticipated, even by plants at present well supplied with labor. The most serious issue in New England at this writing appears to be the coal question. Industrial customers of the New England Power Company have been notified to reduce their energy consumption by the equivalent of one twenty-four-hour working day a week on account of coal shortage, and central stations are much disturbed over the prospect of being obliged to curtail their service. Unfavorable weather has reduced the supply of water for power production compared with a year ago. Great efforts are being made to secure coal and to economize in the use of that in hand, but lack of transportation facilities and railroad embargoes are fast producing a situation of grave menace. There never was a time when the value of hydroelectric power was so apparent.

CHRISTMAS APPLIANCE TRADE.—The week started well, and a vigorous demand is being met from stock. Portables are much in vogue and domestic heating devices are popular. Considering the times business is good.

MOTORS.—Little improvement is to be seen in motor deliveries. Shipments from the Pittsburgh district to Boston average three weeks in transit in full carloads, compared with one week before the war. A few central stations are well stocked, but buying is hesitant in view of the uncertainties due to the coal shortage. No confirmation can be secured as yet regarding the price advances rumored for early 1918. A good deal of "change-over" or efficiency work is in progress, emergency installations for war service offering excellent opportunities for correction and betterment, with reflex effect to the benefit of the fuel situation.

VACUUM CLEANERS AND WASHING MACHINES.—The former are moving fairly well, and one central station is about to start a personal campaign for the sale of the latter equipment.

ELECTRIC RADIATORS.—Continued cold tends to stimulate the sale of these appliances but in some cases where central station customers used radiators recklessly the resulting bills have led to their return.

LAMPS.—The shortage is severe in the lower sizes, notably 10-watt, 15-watt standard and 25-watt tubulars. Sign lamps are beginning to accumulate as the result of the Fuel Administration's curtailment policy. The supply of 25-watt and 40-watt lamps appears adequate for present needs.

WIRE AND CABLE.—Government orders hold the center of the stage, and the "non-essential" industrial customer finds little improvement in the delivery possibilities. Contractors are generally prepared to handle light wiring jobs, but residential work is scarce at present costs.

ATLANTA

Jobbers report increasing activity in specialties to meet the Christmas demand. Dealers state that retail and over the counter sales this Christmas will be the largest ever recorded in this section. Domestic appliances are moving very fast and jobbers are experiencing more or less difficulty in keeping up their stocks of heating devices, vacuum cleaners, washing machines and irons.

The prevailing opinion of manufacturers and jobbers is that freight movements are going to be much slower, at least for some time to come, and this condition will be reflected on deliveries. A few jobbers are placing orders now for shipment during the early part of 1918. There is little doubt that price will be of secondary importance to those that want goods at that time if goods can be delivered, even though there should be a drop in price in the meantime.

The jobbers have done an excellent business this year, and while incomplete figures only are at hand, they indicate an increase of approximately 45 per cent in gross sales for a few of the larger concerns, covering eleven months of this year. All sources report collections as being good, and exceptionally so from the jobber's point of view. Jobbers are in a better shape financially than they have ever been before. This condition is borne out by the fact that the older and some of the younger contracting concerns are doing a very big business, with a corresponding substantial profit, that has permitted them to take care of outstanding obligations in a reasonable time. This, in turn, allowed the jobbers to discount their bills.

While shipments on steel products have been slow during the last few months, the trade has been suddenly informed this week that specific shipment dates cannot be made and, further, that deliveries will be much longer. Local stocks are very low, but prices remain firm.

PORTABLE LAMPS.—The sales in this line have been large and the volume continues heavy as the holidays approach. Shipments have slowed up materially and dealers who foresaw present freight conditions are doing an excellent business.

LAMP CORD.—For a time the dealers of this section secured cord under difficulties, but the cantonment demand has about ceased; the manufacturers are beginning to master the raw-material situation, and local stocks are starting to accumulate.

TRANSFORMERS.—A slight improvement is noted in shipment promises. Special voltages and off-standard ratings, however, show little change. Owing to the betterment of deliveries in standard ratings up to 25 kva., some of the manufacturers can now make shipment from district stocks.

METERS.—Deliveries are good on the residence type and promises of delivery on the polyphase types are more encouraging.

SEATTLE

Northwest jobbers and dealers, those in Seattle and contiguous territory particularly, in commenting on pre-holiday electrical sales, state that Christmas tree lighting outfits are not moving so well as expected, although sales are comparatively satisfactory. The reason given for the decrease in sales this year as compared with former years, the last two particularly, is that households which desire electric outfits are supplied. Sales of lamps for outfits in previous years were heavy. Sales of washing and sewing machines are extremely heavy and are increasing with the approach of Christmas. Other household appliances, including percolators, chafing dishes, curling heaters, electric tea kettles, disk stoves, warming pads, etc., are moving in a first-class manner, although not to the extent expected and strongly predicted. It is believed now that heavy buying of electrical presents will not fully materialize until two or three days preceding Christmas. Dealers still confidently expect large purchases as a result of the campaign for an electrical Christmas started several weeks ago. The daily increasing volume of sales justifies their optimistic statements. Reports from suburban towns and the larger Northwest cities state that holiday sales are satisfactory. Reports from Portland and Spokane especially state that the volume of sales is increasing.

There is a little stocking up on all items for which it is felt there will be a regular demand during the coming year. This activity is expected to spread to every jobbing house in the Northwest. Jobbers are becoming more and more apprehensive of shortages along certain lines, owing to a reported list of non-essentials which the government is working on, and some are intent upon stocking up on items which may fall under that head. A prevalent feeling noted is that jobbers and dealers are at last subscribing to the theory that the war will extend over a period of at least two or three years more; therefore they will make their plans accordingly as applied to stocks. A reported embargo by the railroads, working in conjunction with the government, is also causing jobbers and dealers to build up stocks.

There is an overstock of materials for building purposes, especially wiring devices and fixtures. No outward signs are noticeable of increasing activities in building. Inquiries and a few orders for electrical equipment are trickling in from mines in the Spokane and Coeur d'Alene districts. This business is expected to increase with the coming of spring. Sales to shipyards and industrial plants continue in a steady, satisfactory flow. The Portland field reports a slight increase in sales over last week owing to recent contracts for ships received. Government buying for the navy yard and cantonments is about the same as reported for the last two weeks. The labor situation is extremely acute and was accentuated recently by the heavy enlistments. Electrical men are hit hard, and many have tried or are trying to replace with women the men who have enlisted. This applies particularly to wholesalers.

Shortages along lines heretofore reported still obtain, with no prospect of betterment. A feeling prevails that the situation will get worse instead of better. Orders from several public service corporations throughout the State of Washington for wire, transformers, pole-line material, etc., for reported extensions, have not materialized. It is thought now that this work will go over into next year. No increases in prices are noted. Collections are good.

SAN FRANCISCO

Electrical merchandising interests throughout California anticipate notable business improvement from the co-operative movement for which a fund of $12,000 has been subscribed by contractors and dealers, jobbers, central stations and manufacturers. Of course, time will be required to produce the results desired, but the topic is uppermost in the field because the campaign is now being planned and organized. It is being pointed out that if results are in fact achieved to the extent expected by improvements in display, advertising and merchandising methods generally, there will be a permanent arrangement for keeping up the high standard in these lines which will put the percentage of sales in this territory at a record height.

Reports from southern California indicate that electrical business there is affected more seriously than in the San Francisco district by war conditions. In Los Angeles the absence of extensive industries or a high percentage of tributary territory used for agricultural purposes has left the field without an active substitute for declining construction business. The contractor and dealer suffer more from this than do other branches of the industry, because shipbuilding has been steadily increasing in the Los Angeles and San Diego districts and large orders for motors and supplies are being placed direct with the jobbers. This week, for example, a recently formed shipbuilding company launched its first 5000-ton steel vessel in Los Angeles harbor, and it has announced that the contracts for more of the same type have just been extended to call for eighteen instead of eight, as first planned.

San Diego now has more people than at any time during the Exposition year, exclusive of the 30,000 soldiers quartered at the cantonment, and industrial activity is well above normal. In addition to the extensions of the cantonment which have been ordered, plans for construction involving two governmental departments at that point have been decided upon. Several large factories are contemplated or just under way, and a transmission line is being built to tie in the local power company with the system that serves the Los Angeles territory.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size		List per 1000 Ft.
No. 14	solid	$61.00
No. 12	solid	71.00
No. 10	solid	90.00
No. 8	solid	106.00
No. 6	solid	145.00
No. 10	stranded	95.00
No. 8	stranded	115.00
No. 6	stranded	160.00
No. 4	stranded	205.00
No. 2	stranded	266.00
No. 1	stranded	315.00

Twin-Conductor

No. 14	solid	104.00
No. 12	solid	135.00
No. 10	solid	185.00
No. 8	stranded	235.00
No. 6	stranded	370.00
No. 4	stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid
Less than coil.....List to $61.00
Coil to 1000 ft..... 5% to $59.17
No. 12 Solid
Less than coil.....List to $71.00
Coil to 1000 ft..... 3% to $68.87

Twin-Conductor

No. 14 Solid
Less than coil.....List net to $105.00
Coil to 1000 ft.....$70.00 to 10%
No. 12 Solid
Less than coil.....List net to $135.00
Coil to 1000 ft.....10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid
Less than coil.....List +10%
Coil to 1000 ft.....—10%
No. 12 Solid
Less than coil.....+ 10%
Coil to 1000 ft.....—10%

Twin-Conductor

No. 14 Solid
Less than coil..... + 10%
Coil to 1000 ft..... — 10%
No. 12 Solid
Less than coil.....+ 10%
Coil to 1000 ft.....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....List to 10%
1/5 to std. pkg.....15% to 20%
Std. pkg. .....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....List to 20%
Std. pkg. .....28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	$0.40	$0.40
12 to 50.....	.35	.35
50 to barrel.....	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.....	$0.40	$0.40
12 to 50.....	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16.....	250	$5.00
⅜.....	250	7.50
½.....	100	10.00
¾.....	50	13.00
1.....	50	21.00
1¼.....	50	26.00
1½.....	25–50	35.00
2.....	25–50	45.00
2½.....	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
¾-in. s. stp.....	$75.00	$69.75
¾-in. d. stp.....	78.75	72.00
½-in. s. stp.....	100.00	93.00
½-in. d. stp.....	100.00	96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
¾-in. single strip....	$75.00	$63.75
¾-in. double strip...	71.25-78.25	71.25
½-in. single strip....	100.00	85.00
½-in. double strip...	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32.....	$0.05½	1.....	$0.25
⅛.....	.06	1¼.....	.33
¾.....	.09	1½.....	.40
½.....	.12	1¾.....	.47
⅝.....	.15	2.....	.55
¾.....	.18	2¼.....	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $25.00-$55.00	$20.50-$24.75	$20.00-$22.00
¼-in.— $28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in..$55.00	$25.00-$37.50	$22.50-$24.75
¼-in....$60.00	$27.00-$30.00	$25.00-$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼.....	$0.08½
⅜.....	.08½
½.....	.08½
¾.....	.11½
1.....	.17
1¼.....	.23
1½.....	.27½
2.....	.37
2½.....	.58½
3.....	.76½

	Couplings, List	Elbows, List
¼.....	$0.05	$0.19
⅜.....	.06	.19
½.....	.07	.19
¾.....	.10	.25
1.....	.13	.37
1¼.....	.17	.45
1½.....	.21	.50
2.....	.28	1.10
2½.....	.40	1.80
3.....	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb..	4% to 6%	7% to 9 %
2500 to 5000 lb....	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb.	...3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price .....$5.00 to $6.00
Discount ....25% to 30%

CHICAGO

List .....$5.00 to $6.00
Discount .....25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.....	100	$0.25
35-amp. to 60-amp.....	100	.35
65-amp. to 100-amp.....	50	.90
110-amp. to 200-amp.....	25	2.00
225-amp. to 400-amp.....	25	3.60
450-amp. to 600-amp.....	10	5.50
600-Volt		
3-amp. to 30-amp.....	100	$0.40
35-amp. to 60-amp.....	100	.60
65-amp. to 100-amp.....	50	1.50
110-amp. to 200-amp.....	25	2.50
225-amp. to 400-amp.....	25	5.50
450-amp. to 600-amp.....	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $36.56
Coil to 1000 ft.	22.30 to 27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $24.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 26.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N. C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	Net to 14%
1/5 to std. pkg.	Net to 30%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3. P. S. T.	1.80
60-amp. 3. P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List net to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	—11%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	—5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	List to 10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼ to $0.49
No. 18, full spools	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12.	23.25- 27.09	21.31- 23.22	19.35- 20.85
10.	32.40- 37.80	29.70- 32.40	27.00- 29.25
8.	45.70- 53.34	41.90- 45.72	38.00- 41.38
6.	72.40- 84.42	66.35- 72.36	60.20- 65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	26.95-27.79	23.41-26.95	19.85-23.10
10	33.24-38.25	30.47-32.72	27.70-30.60
8	47.04-54.29	43.12-45.47	39.20-43.42
6	68.25-92.61	62.05-79.23	55.85-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 B. & S.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$35.25 to $40.00
25 to 50 lb	36.25 to 39.00
50 to 100 lb	34.25 to 38.00

CHICAGO

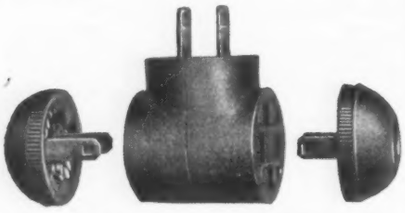
	Per 100 Lb. Net
Less than 25 lb	$40.00 to $40.35
25 to 50 lb	39.00 to $39.35
50 to 100 lb	38.00 to 38.35

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Double Service Receptacle

A "duplex adapter" which transforms a single outlet receptacle into a double service receptacle from which two portable lamps or devices can be simultaneously fed has been added by the Bryant Electric Company of



CONSISTS OF A DOUBLE RECEPTACLE AND PLUG COMBINED

Bridgeport, Conn., to its "Spartan" line of interchangeable receptacles and plugs.

The new device, which is known as the "EH Spartan duplex adapter," consists virtually of a double "Spartan" receptacle and a "Spartan" plug combined. The plug can be inserted into any of the standard "Spartan" receptacles and two outlets are then provided which will take a "Spartan" plug cap of either the "parallel" blade or the "polarity" type. It can also be used in conjunction with the "Spartan screw-base adapter" to transform an Edison screw-base socket or receptacle to a duplex "Spartan." The adapter is National Electrical Code standard.

Electric Soldering Iron for Garages

The Dover Manufacturing Company, Dover, Ohio, is now offering the trade an electric soldering iron designed especially for use in garages and other places where intricate work is necessary. The iron contains a Vea heating element which is standard with the Dover company. A flanged copper core runs the full length of the heating element. The resistance coils are wound around a thin tube of vitrified clay. The

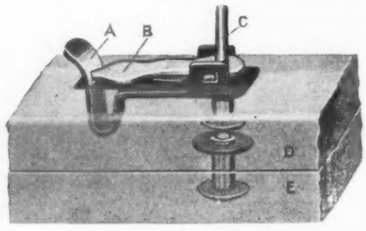
MADE EXPRESSLY FOR INTRICATE WORK

insulating material is forced between the vitrified tube and the copper core and between the coils and the steel casing. This construction is designed to prevent trouble. The heating element is sealed in the steel casing to prevent tampering.

The copper soldering tips are made from drawn copper bars and are subjected to special heat treatment. The soldering tips screw into the copper core, and hence can be removed easily. Inside of the wooden handle is a fiber terminal point. The wooden handle unscrews so that the connection can be adjusted or renewed if necessary. The iron weighs 31 oz. (877 g.) and is 15 in. (38.1 cm.) long. It operates on a potential of 110 volts, and the heating element is rated at 225 watts.

Simple Holder for Filing Drawings

The National Company, Boston, Mass., is putting out a new device called the "Presto holder" for filing blueprints, drawings, etc. The holder consists of two wood strips, designated as *D* and *E* in the accompanying illustration, between which the prints are clamped. It carries three locking de-



HOLDING CLAMPING DEVICE

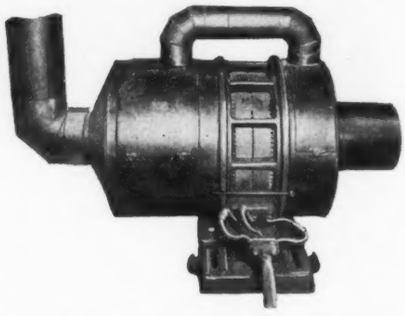
vices, the middle one being located off center for convenience in clamping narrow prints. The locking mechanism has two parts, *A* and *B*, which are pressed as desired either to lock or to release *B* from the stud *C*, which is securely fastened in the lower strip.

The holders are made in 30-in., 36-in. and 42-in. (76.2-cm., 91.4-cm. and 106.7-cm.) lengths, each holder having a capacity of sixty prints. An index card holder is attached for filing purposes, and hooks are provided for hanging on the wall or in rows on a suitable rack.

Motor Protection System

A motor protective device which, it is claimed, does away with the trouble and expense of cleaning motors, reduces the temperature and increases the efficiency, allows the carrying of a large overload without shortening the life of the motor, and eliminates fire hazards and loss of money due to breakdowns, is shown in the accompanying illustration. The usual type of installation consists of casings which inclose each end of the motor and make it dustproof, a fan attached to the end of the motor shaft, a dust separator, and an air-intake pipe running to a clean air supply, preferably out of doors.

When the motor is started the fan

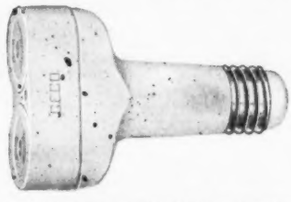


METHOD OF PROTECTING MOTOR

draws in air through the dust separator and forces it against the rear end of the motor, through the windings and out through the laminations. Part of the air is forced through a by-pass to the front hood so that the same action takes place on both sides of the motor. The motor casings are provided with large doors to permit of a ready inspection of brushes, resistance, air-gap, bearings, etc. The dust separator is also provided with doors so that the screens can be easily removed. The equipment can be applied to motors without moving them and requires a very short time to install. This apparatus is made by the Motor Protection Company of Pawtucket, R. I.

Separable Device

A recent addition to the line of the General Electric Company's separable devices is a porcelain twin-outlet separable attaching plug. By the use of



TWIN OUTLET SEPARABLE ATTACHING PLUGS

this device two portables equipped with "Standard" caps can be used in the same outlet. A feature of this improved plug is length of the stem, which is of sufficient length to enable the device to be secured into a socket or receptacle having a shade attached.

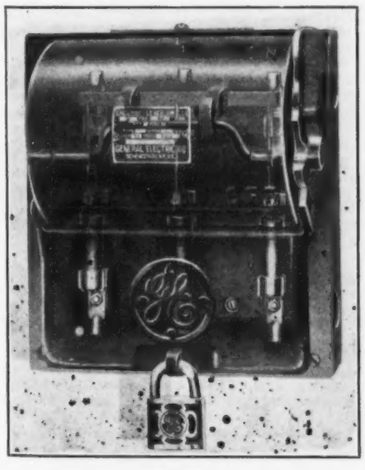
Improved Safety-First Inclosed-Lever Switch

The General Electric Company has recently introduced an improved inclosed-lever switch that, it is said, may be classed as "safety first" in every respect. The device has been examined by the National Board of Fire Underwriters and approved as "safety first" from the standpoint of both fire and casualty hazards. The switch is especially adapted to the control of motor drive on machine tools or for lighting and power circuits. It uses N. E. C. S. fuses and is limited in capacity only by the rating of approved fuses of this class.

The phantom view here reproduced shows a triple-pole safety-first switch of this type. The unit consists essentially of an externally operated standard lever switch inclosed in an iron case and so arranged that all current-carrying parts are inaccessible while alive. This feature is secured by means of a simple interlock so arranged that the cover to the fuse compartment cannot be opened while the switch is closed nor can the switch be closed while the fuse compartment is open. The screws holding the main cover of the box are covered by the fuse cover so that they cannot be removed while the fuse cover is closed.

The operating mechanism is very simple. The handle on the standard lever switch is replaced by a hook-shaped casting which engages with a curved shaft operated by the externally mounted handle as shown.

Provision is made for locking the switch in the "off" position with from one to three individual padlocks. Means are also provided for padlocking the fuse cover to prevent unauthorized persons from tampering with the fuses. The switch box is provided with knockouts for conduit wiring, two knockouts being placed at each end and two at each side of the box. Split porcelain bushings to



TRIPLE-POLE SAFETY-FIRST SWITCH

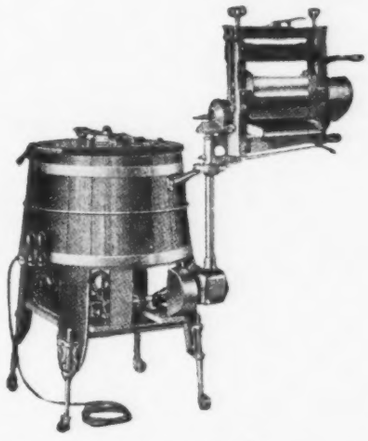
protect the wires in open wiring work are supplied, two at each end for two-pole, three for triple-pole and four for four-pole switches. The switch is adapted to single or group mounting, and when mounted in groups it may be provided with a bus compartment for inclosing all incoming wires and connections.

Another accessory is the safety catch. When this catch is used the operator cannot close the switch without using both hands, one to hold the catch in the released position and the other to operate the switch handle, thus removing the possibility of accidental closure

Dolly-Type Washer

The Automatic Electric Washer Company of Newton, Iowa, has just added to its line of dolly-type wooden-tub machines two models known as models 9 and 10. The former is a belt-power type for operation with gasoline engine or power stand such as is furnished with some of the farm lighting plants, while model 10 is equipped with an electric motor for operation from any source of electric power, including farm lighting plants.

The wringer swings into four different positions and is reversible, and the machine will wash and wring at the same time. With these models it is possible to be washing one batch of



CAN BE OPERATED BY ENERGY FROM FARM LIGHTING SETS

clothes while wringing another from the rinse or bluing water. Both models are gear-and-chain-driven, no belts being used. The model 10 has adjustable casters so that the height can be altered at will. The electric machines are equipped with Emerson motors.

Table Stoves

A table stove which has a three-heat switch directly attached to it and made a part of the stove, so that the user can obtain any degree of heat desired, has been brought out by the Rutenber Electric Company of Marion, Ind. This stove is also supplied with custard cups which can be used for several different operations, such as poaching eggs, making cup custards, etc., and by using the deep pans on top of the stove, one turned over the other, this part of the stove can be made into a bake oven, baking such articles as biscuits, muffins, drop cakes, cookies, etc. The makers point out that it can be used for baking potatoes and other food.

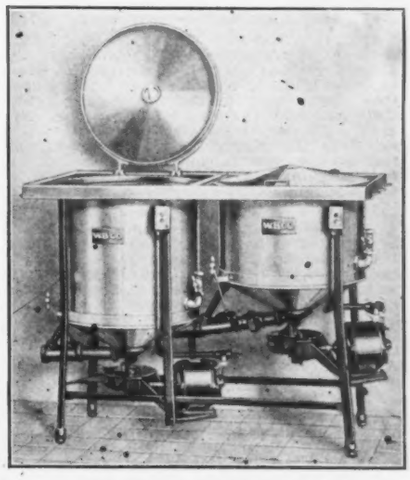
A uniform degree of heat can be maintained, and the maximum temperature obtained is 660 deg. Fahr. (349 deg. C.). The minimum temperature is 275 deg. Fahr. (135 deg. C), which gives an ample range for any

THREE-HEAT SWITCH IS PART OF STOVE

baking operation desired. It is also pointed out that by using the pans underneath the heating element excellent results can be obtained by broiling steaks, pork chops, toasting bread, etc.

Heavy Service Electric Dishwasher

The Walker Brothers Company of Syracuse, N. Y., announces an electric dishwashing machine designed for heavy duty. The machine carries two tanks, a shallow one which is intended for rinsing only and a deep container in which the washing operation is performed. Water from the rinsing tank drains into the second and larger division from which soiled water is drained out. This arrangement, the manufacturer points out, facilitates the washing of dishes in large quantity. Two trays may be handled at one time and the washing and rinsing operations require only from one to two minutes'



DESIGNED FOR HEAVY DUTY

time. Each of the trays has a capacity of thirty-five to seventy-five pieces. Individual motors are directly connected with each tank. The entire machine occupies a space of only 2 ft. by 4½ ft. (6 m. by 1.4 m.).

Trade Notes

G. A. PETERSON, Baltimore, Md., has been appointed manager of the Philadelphia office of the A. B. See Electric Elevator Company.

THE DEPARTMENT OF COMMERCE of Washington has published and has ready for distribution "Foreign Tariff Notes" No. 25, with cumulative index for Nos. 22 to 25.

SAMUEL D. WESTLER has opened an office as manufacturers' agent, specializing in electrical merchandise, at the Postal Telegraph Building, 253 Broadway, New York City.

HAL C. WYATT now represents the Northwestern Electric Equipment Company, St. Paul, Minn., in the western Montana territory. Mr. Wyatt succeeds W. H. Plume, who resigned.

THE ARTHUR JONES ELECTRIC COMPANY announces the removal of its general offices and salesroom to 2837 South State Street and of its salesroom to 8 East Twenty-ninth Street, Chicago.

THE FRANTZ-PREMIER DISTRIBUTING COMPANY has removed its salesroom and offices from 119 West Forty-second Street to 2010 Broadway, New York City, where more suitable quarters have been taken.

THE SQUARE D COMPANY of Detroit, Mich., is the new name of the Detroit Fuse & Manufacturing Company, which has sold its fuse business to the Economy Fuse & Manufacturing Company. The company will continue to make Square D switches and meter protective trim.

THE JEFFERSON ELECTRIC MANUFACTURING COMPANY of Chicago warns the trade against R. A. Spencer, who is purporting to be its representative. The company states he is imposing on different dealers in New England. About a year ago Spencer was reported as active in Ohio, parts of West Virginia and Pennsylvania.

THE JEFFRY-DE WITT COMPANY, Detroit, manufacturer of high-tension insulators and other porcelain specialties, is erecting a new factory at Huntington, W. Va., for the exclusive manufacture of high-tension insulators. This factory will have a capacity of 500,000 units per annum and will be capable of further expansion. According to present plans, the factory will be started about April 15, 1918.

THE W. F. IRISH COMPANY is a new jobbing firm at 130 West Thirty-second Street, New York City. The company is owned and controlled by W. F. Irish, who is a well-known metropolitan jobber, having been connected with various firms during his career, and F. S. Gardiner, who was sales manager for Sibley & Pitman for twenty-five years. Both of the partners will take an active part in the conduct of the business.

THE HOME LIGHT & POWER COMPANY of Charlotte, N. C., recently held a four-day convention of its salesmen and dealers at Dayton, Ohio, where the plant of the Dayton Engineering Laboratories Company, which makes the "Delco light," distributed by the Home company, is situated. The meetings were held Dec. 4, 5, 6 and 7 at the Miami Hotel, and an inspection of the new Delco factory was an interesting feature of the gathering.

THE ANACONDA COPPER MINING COMPANY, Great Falls, Mont., is erecting a rod and wire manufacturing plant, which is expected to be in operation in the spring. Its annual capacity on an eight-hour working-day basis will be 62,400,000 lb. of rods and 27,520,000 lb. of wire, and it will consume one-fifth of the output of the Anaconda company. The plant will cost more than $500,000 and will mark the entry of the Anaconda into the manufacturing field. A brass manufactory is expected to be erected after the rod and wire mill is completed.

THE BRIDGEPORT BRASS COMPANY of Bridgeport, Conn., in addition to supplying group life insurance for its workers, has inaugurated a plan which also includes benefits for accidents and sickness along the lines of the compensation laws of some states. Under the Bridgeport company's plan any employee may receive one-half of his wages, up to a certain maximum, for a period not to exceed twenty-six weeks, for disability or sickness and a maximum life insurance policy of $1,000. A publication is issued by the sick benefit association of the Bridgeport Brass Company entitled "A Co-operative Plan of Benefits Covering Accidents, Sickness and Death."

THE ECONOMY FUSE & MANUFACTURING COMPANY of Chicago announces that it has purchased the entire fuse business of the Detroit Fuse & Manufacturing Company, maker of the "Arkless" inclosed fuses. The transaction includes the conveyance of all merchandise, materials, machinery, tools, designs, patents, good will and unfilled orders. The physical assets of the Detroit Fuse & Manufacturing Company in so far as they pertain to the making of fuses have been shipped to the Chicago plant of the Economy company, where the manufacture of "Arkless" fuses will be continued, production being, as heretofore, under the label service of the Underwriters' Laboratories, Inc. The "Square D" line of inclosed safety switches remains the property of the Detroit Fuse & Manufacturing Company.

Trade Publications

AUTOMOBILE SWITCHES. — Hubbell automobile switches are listed in bulletin No. 16-1, issued by Harvey Hubbell, Inc., of Bridgeport, Conn.

CABLE-WAY CARRIAGES.—The Blaw-Knox Company of Pittsburgh, Pa., has issued a leaflet descriptive of its "Blaw" locking cableway carriages.

GAS-OVEN FURNACES.—Tate-Jones & Company, Inc., of Pittsburgh, Pa., has issued bulletin No. 160, descriptive of its recuperative gas-oven furnaces.

CIRCUIT BREAKERS.—Type FK-25 oil circuit breakers made by the General Electric Company of Schenectady, N. Y., are illustrated and described in bulletin No. 47471.

BLUE-PRINT HOLDER.—The Presto blue-print record, chart, drawing and newspaper holder is described in a folder prepared by the National Company, 273 Congress Street, Boston, Mass.

FLOOR MACHINE.—The "Utility" floor machine for polishing, scrubbing and sandpapering all kinds of floors is described in a booklet prepared by the Kent Vacuum Cleaner Company, Inc., of Rome, N. Y.

COIL TESTERS.—A booklet descriptive of Jefferson combination lamp, plug, horn and Ford coil unit testers has been prepared by the Jefferson Electric Manufacturing Company, 426 South Green Street, Chicago.

ELECTRICAL SERVICE.—A booklet is being distributed by the Denton Engineering & Construction Company of Kansas City, Mo., outlining this firm's electrical service and its facilities for handling repair and construction work.

HYDRAULIC TURBINES.—The I. P. Morris Company of Philadelphia, Pa., has prepared bulletin No. 4, descriptive of its hydraulic turbines. This complete and well-illustrated bulletin includes a general history of the firm, shop views, a list of wheels built by this company, efficiency curves of turbines, an article on "The Efficient Use of Water Power," and a number of plant illustrations giving views of I. P. Morris turbines.

ELECTRICITY IN RUBBER FACTORIES.—"Electrical Equipment for Rubber Factories" is the title of an elaborately illustrated publication (circular No. 7352), with an attractive art cover, which has just been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The advantages of motor drive, particularly for the calender, are explained in some detail, and a number of views of different motors and control are shown. A large number of illustrations of application of motors to the rubber industry, taken in different parts of the country, are used. The equipment of the Howe Rubber Company, New Brunswick, N. J., is featured and a number of illustrations of this up-to-date plant are shown.

ELECTRICAL EQUIPMENT FOR TEXTILE INDUSTRY.—The application of electricity to the textile industry is thoroughly described and illustrated in circular No. 7153, entitled "Electricity in the Textile Industry," just issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It was distributed at the Southern Textile Exposition at Greenville, S. C., Dec. 10-19. The publication is profusely illustrated with applications of electric motors to the industry, a number of views being shown illustrating the different methods of drive employed in textile mills. Considerable space is devoted to lighting, which is an important feature in all industrial establishments, especially textile ones. This book will be sent free on application to any one interested.

New Incorporations

THE DAYTON (OHIO) ELECTRICAL MANUFACTURING COMPANY has been incorporated with a capital stock of $125,000 by H. G. Catrow and others.

THE GREEN LIGHT & POWER COMPANY of Pleasant Hill, Mo., has been incorporated with a capital stock of $150,000 by L. K. Green, L. R. Green and others.

THE FINLEY LIGHT COMPANY of Ozark, Mo., has been incorporated with a capital stock of $10,000 by George T. Braezale, F. W. Barrett and D. W. Bingham.

THE STANDISH ELECTRIC COMPANY of Cincinnati, Ohio, has been chartered with a capital stock of $10,000 by P. H. Standish, John E. Devere, G. B. Jolly, H. B. Street and H. F. Gravenkemper.

THE ELECTRIC MANUFACTURERS' AGENCY of Seattle, Wash., has filed articles of incorporation with a capital stock of $20,000. The incorporators are: Joseph Schoemer, George Buckman and W. Funfsinn.

THE ERWALDSON MANUFACTURING COMPANY of St. Pauls, N. C., has been chartered by W. D. Johnson, A. R. McEachern and G. T. Fisher. The company is capitalized at $25,000 and proposes to manufacture electrical supplies.

THE AIRCRAFT SPECIALTIES COMPANY of Garwood, N. J., has been incorporated with a capital stock of $25,000 to manufacture electric motors. The incorporators are: William B. Elliott, William Siebenmorgan and George A. Elliott.

THE EXCELLO GAS COMPANY of Baltimore, Md., has been incorporated with a capital stock of $10,000 by Louis M. Rubin, 312 North Eutaw Street, Baltimore; Harry Rubin and S. Want. The company proposes to deal in gas and electrical appliances.

THE E. R. KIBLER COMPANY of Wilmington, Del., has been incorporated by C. L. Rimlinger, C. M. Egner and M. M. Clancy of Wilmington, Del. The company is capitalized at $200,000 and proposes to do a general electrical and mechanical engineering business.

THE ELECTRO PRODUCTS CORPORATION of Wilmington, Del., has been incorporated by M. L. Horty, L. A. Irwin and Harry W. Davis of Wilmington. The company is capitalized at $500,000 and proposes to manufacture machines under electrolyte, chemical and other processes.

THE MOTORLESS SIGN FLASHER COMPANY of Dover, Del., has been incorporated with a capital stock of $300,000 to manufacture electric machines, storage batteries and accessories. The incorporators are: A. M. Halloran, S. A. Williams and Ferries Giles of Wilmington, Del.

THE BREENER GAS & BY-PRODUCTS CORPORATION of New York, N. Y., has been incorporated with a capital stock of $100,000 by Samuel B. Howard, George V. Reilly and Arthur W. Britton, 65 Cedar Street, New York City. The company proposes to do a general electrical and mechanical engineering business.

THE BEECH BOTTOM POWER CORPORATION of Wheeling, W. Va., has filed articles of incorporation with a capital stock of $40,000 to operate in Brooke County. The incorporators are: Allen E. Moore, George F. Jebbett of New York, N. Y.; Alfred F. McCabe, F. H. Butchorn and S. C. T. Dodd of Brooklyn, N. Y.

THE WEST TEXAS UTILITIES COMPANY of Abilene has been incorporated with a capital stock of $400,000 by George W. Williamson, 72 West Adams Street, Chicago, Ill.; J. M. Dickie, J. F. Meadows and F. A. Matthes, all of Abilene; A. Hargrave and Sidney G. Vigo of Dallas. The company has taken over the properties of the Abiline Gas & Electric Company, the Baird (Tex.) Gas & Electric Company, and the Hamlin (Tex.) Gas & Electric Company.

THE EAST TEXAS UTILITIES COMPANY of Marshall has been chartered with a capital stock of $300,000 and has acquired the holdings of the Marshall Electric Company, the Marshall Traction Company and the Marshall Ice Company; the Jefferson (Tex.) Ice & Light Company and the Longview (Tex.) Ice & Light Company. The incorporators are George W. Williamson, 72 West Adams Street, Chicago, Ill.; J. M. Dickie, J. F. Meadows and F. A. Matthes, all of Abilene; A. Hargrave and Sidney G. Vigo of Dallas.

New England States

SPRINGFIELD, VT.—To provide for better service on its Claremont-Cavendish transmission line, the Colonial Power & Light Company has begun work on an extension of its line from Claremont to Windsor. This line has heretofore been tied in with the Claremont-Cavendish line about 5 miles from Claremont, and the company is planning to extend the line and bring it directly into the Claremont substation.

BROCKTON, MASS.—The Sewerage Commissioners have awarded the contract for the new electrical equipment for the Campello sewerage pumping station to the Power Equipment Company of Boston, at $12,750. The contract calls for DeLaval centrifugal pumps and Westinghouse motors and switchboards.

EASTHAMPTON, MASS.—The Turners Falls (Mass.) electric company has petitioned the Selectmen for permission to erect transmission lines in East and Hendricks Streets. The company is making an effort to get into Westfield by way of Southampton.

FALL RIVER, MASS.—The Fall River Electric Company has petitioned the Council for permission to install underground conduits on School Street, between Maple and Prospects Streets.

LENOX, MASS.—Work has begun on the erection of a new high-tension transmission line from the central distributing station of the Lenox Electric Light Company on Walker Street to Lenoxdale, where it will connect with the high-tension line of the Pittsfield Electric Company, running from Lee. For part of the distance the wires will be placed underground. The new line will provide auxiliary service for Lenox.

NEW BEDFORD, MASS.—Plans have been filed by the J. S. Rhodes Company, 128 Front Street, for the construction of a new one-story addition, 25 ft. by 40 ft., to its power plant, to cost about $10,000.

WORCESTER, MASS.—The new substation on Grafton Street of the Worcester Electric Light Company, it is expected, will be completed by the first of the year. The station will be equipped with four 200-kva. and three 300-kva. transformers. This is the largest substation of the company and will cost more than $100,000.

Middle Atlantic States

BUFFALO, N. Y.—The Hydro-electric Association has made recommendations to the City Council for the immediate erection of a municipally owned power plant at Niagara Falls. The association has also negotiations under way with the Council for assistance in making revisions in the treaty with Canada for the purpose of providing more power at that point.

GREENPORT, N. Y.—The Public Service Commission has granted the Albany Southern Railroad Company of Albany permission to erect and operate electric transmission lines in the town of Greenport, which was opposed by the Red Hook (N. Y.) Light, Heat & Power Company, which also has a franchise granted by the town, but was not exercised within the time limit.

GREEN ISLAND, N. Y.—The Standard Oil Company has applied to the Village Council for street lamps to be erected along Front Street, which extends from Albany Avenue south to the village line at the end of the state basin. Green Island has not a post office.

NEW YORK, N. Y.—The capital stock of the Artificial Daylighting Company, 461 Eighth Avenue, New York, has been increased from $50,000 to $500,000, the proceeds to be used for expansion.

NEW YORK, N. Y.—Contract has been awarded by Joseph Stern & Son, 618 West Fortieth Street, New York City, for the construction of a new two-story power plant addition, 25 ft. by 45 ft., to E. W. Broderick, 110 West Fortieth Street.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 7, 1918, for furnishing and installing one 40-ton and two 10-ton overhead electric traveling bridge cranes and runway trolley wires on the runways in the extension to the machine shop building 128, at the navy yard, New York, N. Y. Drawings and specifications (No. 2720) may be obtained on application to the above bureau or to the commandant of the navy yard named.

NIAGARA FALLS, N. Y.—The Lower River Power Company is contemplating the construction of a hydroelectric power plant to develop 350,000 hp. on the Lower Niagara River, if permission is granted by Congress. James S. Simmons, former Congressman, is interested in the company.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company has submitted a proposal to the City Council offering to replace the arc lamps now in use with incandescent lamps, varying in candlepower from 100 to 400 units.

OTISCO, N. Y.—An electric plant is being installed to supply electricity for lighting Otisco. E. T. Harter is interested.

POUGHKEEPSIE, N. Y.—Arrangements have been completed for illuminating the Catskill Aqueduct with electric lamps from Ashokan Dam to Hill River Reservoir, in Yonkers. Energy for the lamps in Orange and Ulster counties will be furnished by the Hudson Gas & Electric Company of Poughkeepsie; in Putnam and Dutchess counties power will be supplied by the Cold Spring (N. Y.) Power Company, and by the Westchester Lighting Company in Westchester County.

RICHMONDVILLE, N. Y.—The Schoharie Valley Light & Power Company of Esperance has applied to the Village Board of Trustees for a franchise to supply electricity in Richmondville. Owing to being unable to obtain coal the Great Bear Light & Power Company of East Worcester, which has furnished electrical service here for nine years, has been obliged to close down its plant.

ROCHESTER, N. Y.—Contract has been awarded by George Keith, 155 Exchange Street, to A. Friederich & Sons Company, 710 Lake Avenue, Rochester, for the construction of a new one-story power house, 25 ft. by 50 ft., at his plant to cost about $10,000.

SOUTHAMPTON, N. Y.—At a special meeting to be held Dec. 19 the stockholders of the Suffolk Light, Heat & Power Company will vote on the resolution to transfer its franchise and property to the Long Island Lighting Company of Northport.

SYRACUSE, N. Y.—The Board of Contract and Supply has awarded the contract for electrical fixtures at the Delaware School to the Southwick Electrical Company of Cortland, N. Y., at $3,000.

BLOOMFIELD, N. J.—Plans have been filed by the Power Specialty Company, 111 Broadway, New York City, for the construction of a new plant on Locust Avenue, to cost about $31,000. The company manufactures super-heaters, etc.

ELIZABETH, N. J.—Bids will be received by the Board of Public Works, City Hall, Elizabeth, until Dec. 27 for the following work: (1) For furnishing two 75-hp. horizontal electric motors, complete with hand control equipment and appurtenances; (2) for furnishing the necessary wiring, conduit, insulators, connectors and all material and appurtenances, together with the necessary labor for delivering the motors, control equipment, etc., covered by item No. 1, to the sewage pumping station on Clarkson Avenue, near Summer Street. Specifications may be seen at the office of the city engineer, City Hall. Thomas E. Collins is city engineer.

HOPEWELL, N. J.—Improvements to the street-lighting system are under consideration by the Borough Council. It is proposed to replace the lamps now in use with larger candlepower units.

JERSEY CITY, N. J.—Plans have been prepared for the erection of an addition, about 50 ft. by 50 ft., to the local power house of Swift & Company, at 154 Ninth Street.

JERSEY CITY, N. J.—Bids will be received by the trustees of the free public library, Jersey Avenue and Montgomery Street, Jersey City, until Dec. 27 for the installation of new lighting fixtures in the new library building now being erected on Zabriskie Street. E. W. Miller is secretary.

MORRISTOWN, N. J.—The Board of Aldermen has awarded the contract for lighting the streets of the city for a period of five years to the Morris & Somerset Electric Company of Morristown.

NEWARK, N. J.—Plans have been filed by the Alchol Products Company, Blanchard Street, for the erection of a new one-story power house at its works, for which contract has been awarded to Frederick Kilgus, 13 South Sixth Street, Newark.

ORANGE, N. J.—A permit has been granted to the Radium Luminous Material Corporation, 166 Alden Street, for the construction of an addition to its plant.

PERTH AMBOY, N. J.—Extensions and improvements to the street-lighting system are under consideration by the Board of Aldermen. An appropriation of $25,000 for street lighting during 1918 has been approved.

BIRDSBORO, PA.—The Borough Council has awarded the Birdsboro Electric Company a contract for lighting the streets of the borough for a period of five years.

BRADFORD, PA.—Charters have been granted to the Bradford Township, Foster Township, Keating Township, Lafayette Township, Port Allegany and Smethport Power companies. Each company is capitalized at $5,000. Milwood Oliver is treasurer.

COALDALE, PA.—Plans are being prepared by Lewis Stockton, 35 West Thirty-ninth Street, New York, N. Y., for the construction of a power house at the Panther Creek Valley Hospital, to cost about $8,000.

HARRISBURG, PA.—Plans are being prepared by Clark E. Diehl, city electrician, for extensions and improvements to the underground system for the police and fire-alarm departments.

HARWOOD, PA.—The new 15,000-hp. turbo-generator at the local plant of the Harwood Electric Company has been put in operation. A third unit of 15,000 hp. is to be installed in the near future.

LANCASTER, PA. — The Conestoga Transmission Company has filed notice of an issue of $70,000 in capital stock to provide for extensions, improvements, etc.

LANCASTER, PA.—Preparations are being made by the Atlas Powder Company for the installation of electric motors to operate the new powder plant now being erected at Reynolds.

LANCASTER, PA.—The Edison Electric Company has filed notice with the Public Service Commission of an issue of $50,000 in capital stock, the proceeds to be used for extensions, improvements, etc.

LANCASTER, PA.—The Lancaster County Railway & Light Company has filed notice with the Public Service Commission of an increase in its capital stock from $2,500,000 to $3,750,000 for expansion.

LANCASTER, PA.—Charters have been granted to the Farmers' Electric Companies of Conestoga, Pequea and Marti. Each company is capitalized at $5,000 and the incorporators are: John H. Ware, Jr., C. M. Ware and W. E. Edwards.

MARCUS HOOK, PA.—Plans have been filed by the Headley Good Roads Company, 301 South Thirtieth Street, for the erection of a new power house and shop building, to cost about $75,000. Contract for building has been awarded.

MASONTOWN, PA.—The Youngstown Sheet & Tube Company is contemplating the construction of a new power house at its coal properties near Masontown.

PHILADELPHIA, PA. — The United States Emergency Fleet Corporation, Finance Building, has awarded contract to F. T. Ley & Company of Philadelphia for the construction of a new power house at North Bristol, to cost about $25,000.

PHILADELPHIA, PA.—Wallace & Company have awarded contract to Henry E. Baton, 1713 Sansom Street, Philadelphia, for the construction of a new power house, about 30 ft. by 95 ft., at Eighty-first Street and Island Road, to cost about $10,000.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia & Reading Railway Company for the construction of a new power house, 155 ft. by 215 ft., at its Erie Avenue yards. Contract has been awarded to William Steel & Sons Company of Philadelphia.

PITTSBURGH, PA.—Notice has been filed with the Public Service Commission by the Beaver County Light Company of an issue of $600,000 in capital stock and bonds to the amount of $565,000, the proceeds to be used for improvements, etc.

SCHUYLKILL HAVEN, PA.—Bids will be received by C. A. Faust, superintendent of the Schuylkill Haven electric light department, until Dec. 27 for the erection of a boiler house at the municipal electric-light plant. Plans and specifications may be obtained at the office of the Electric-Light Department.

SOMERSET, PA.—The Johnstown-Somerset Traction Company, which is building an electric railway from Johnstown to Jerome, a distance of 10 miles, is contemplating an extension to Boswell, 6 miles long.

DOVER, DEL.—The Rural Service Company, recently incorporated with a capital stock of $500,000, to supply electricity for lamps and motors in Kent and Sussex and part of the eastern shore of Maryland, it is

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

reported, will soon begin active work in Delaware and Maryland. William G. Taylor of Wilmington and Joseph P. Bryan are among the incorporators.

BALTIMORE, MD.—The Penn Seaboard Steel Corporation, it is reported, has decided to build an addition to its works on the Delaware River, near Wilmington, Del., which will include a power house to cost about $300,000. The cost of the entire work is estimated at about $2,000,000.

HIGHLANDTOWN, MD.—Contract has been awarded by the Crown Cork & Seal Company, Guilford Avenue, Baltimore, to the West Construction Company, American Building, Baltimore, for the construction of a new power house in Highlandtown. The building will be about 55 ft. by 115 ft., and will cost about $15,000.

INDIANHEAD, MD.—The Dawson Construction Company, May Building, Pittsburgh, Pa., submitted the lowest bid ($39,000) for the construction of an addition to the power house at the naval proving ground at Indianhead.

MOUNT SAVAGE, MD.—Plans are being considered by the United Bid Vein Coal Company for equipping its plant throughout for electrical operation.

ANSTED, W. VA.—The Mill Creek Colliery Company, it is reported, will rebuild its power plant, recently destroyed by fire, causing a loss of about $40,000.

DUNBAR, W. VA.—The Dunbar Traction Company, it is reported, will rebuild its electric power plant and car barns, recently destroyed by fire, causing a loss of about $75,000.

NEWPORT NEWS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract for the construction of an electrical school and general school at the naval operating base at Hampton Roads to Harwood & Moss, of Newport News, at $297,750.

NORFOLK, VA.—Surveys, it is reported, are being made by the Virginia Railway & Power Company for an extension to Pig Point.

NORFOLK, VA.—Steps have been taken to install an ornamental lighting system on Freemason Street, from Church to Boush Street.

PETERSBURG, VA.—The Petersburg & Appomatox Railway Company is contemplating the construction of a central heating plant at Lakemont, near Petersburg. F. A. Bishop of Petersburg is architect.

ROSSLYN, VA.—Plans have been prepared by the Chesapeake & Potomac Telephone Company of Baltimore, Md., for the construction of a new telephone exchange in Rosslyn. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, N. Y., are architects.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Puget Sound, Wash., Schedule 1638—1000 ft. rubber-insulated, interior communication cable, 1000 ft. lighting and power wire, 10,000 ft. single-conductor lighting and power wire, 5000 ft. two-conductor lighting and power wire. Various, Schedule 1637—70,000 sq. ft. insulating, high-pressure blocks; Schedule 1635—miscellaneous flexible voice tubing. Applications for proposals should designate the schedule desired by number.

North Central States

EATON RAPIDS, MICH.—At an election held recently the proposal to issue $30,000 in bonds to purchase the Smithville water power was carried.

MENOMINEE, MICH.—The Menominee Electric Manufacturing Company, manufacturer of electric fans and other appliances, has accepted the proposal of the business men at Cairo, Ill., to remove its business to that city about Feb. 1. The plans provide for the erection of a fireproof plant, including a foundry, on a three-acre site. The company will be reorganized with a capital stock of $250,000. The plant in Menominee will continue in operation at least eight months longer.

THREE RIVERS, MICH.—The City Council has decided to purchase a transformer and other equipment necessary to change the city lighting system from two to three phase. The cost of the improvements is estimated at $700.

CLEVELAND, OHIO.—The American Steel & Wire Company, which is erecting a coke plant on Harvard Avenue, to cost about $400,000, will use all kinds of unloading machinery and will install from five to seven boilers. Several hoisting and magneto cranes, it is understood, will be required. The engineering department of the company is located in the Western Reserve Building, Cleveland.

CLEVELAND, OHIO.—The Board of Education is considering the erection of two new types of school buildings during the coming year, one a 30-room, one-story building, the other a three-story building without corridors and to adjoin a separate building for gymnasium, auditorium and swimming pool and perhaps a separate structure for a power house.

CLEVELAND, OHIO.—Owing to a disagreement between the city officials and the Cleveland Railway Company no lighting system has been installed on the lower level of the new high-level viaduct which connects the east and west sides of the city. At a meeting held recently it was decided that the city would have full charge of installing the system, which will consist of 60 electric street lamps and equipment, to cost from $15,000 to $18,000.

COLUMBUS, OHIO.—The Columbus Railway, Power & Light Company has petitioned the Public Utilities Commission for permission to issue $276,000 in capital stock and $1,000,000 in bonds, the proceeds to be used to pay for extensions and improvements in connection with its new plant.

DELLROY, OHIO.—The Village Council is negotiating with the Van Kirk Coal Company for the installation of an electric-light system here. The coal company is building a large tipple near Dellroy and will install an electric generating plant.

LIMA, OHIO.—A petition has been presented to the City Council by business men on Main Street and the public square asking that the ornamental lighting system be extended to those thoroughfares.

MANSFIELD, OHIO.—Work, it is reported, has begun on the erection of a new plant, 50 ft. by 100 ft., for the Phoenix Electric Company.

OBERLIN, OHIO.—Owing to the lack of coal and gas the Oberlin Gas & Electric Company will secure energy from the Lorain County Electric Company of Elyria. The County Commissioners have granted the Oberlin company permission to erect a transmission line from South Amherst to Oberlin, over which energy will be transmitted.

SALINEVILLE, OHIO.—At an election held recently the proposal to issue $25,000 in bonds for the construction of a municipal electric-lighting plant was carried.

SIDNEY, OHIO.—The Sidney Electric Company, which has purchased the municipal electric plant at De Graff, is planning to erect an electric transmission line from Sidney through Pemberton, Quincy and into De Graff to supply these towns with electricity. A 24-hour service will be established.

TOLEDO, OHIO.—Application has been made by the Kelly Island Lime & Transport Company for a 60-kw. load to be taken from the Marblehead station of the Northwestern Ohio Railway & Power Company, the former to furnish all transformers and to erect approximately 100 ft. of line.

URBANA, OHIO.—The capital stock of the Urbana Light, Heat & Power Company has increased its capital stock from $150,000 to $200,000.

MAYFIELD, KY.—In a decision handed down by Judge C. D. Newell of Maysville, as a special judge, in the suit of the city of Mayfield against the Mayfield Water & Light Company for possession of the water and light plant, rendered a judgment fixing the price of the plant at $272,000, this being the only point in contest. The company asked not less than $325,000 for the plant and the city did not want to pay more than $200,000.

ALBION, IND.—The Hawks Electric Company of Goshen, it is reported, has submitted a proposal to the Town Board to furnish electricity for lamps and motors. The town of Albion operates a municipal water and light plant.

CLINTON, IND.—The Wabash Valley Electric Company has increased its capital stock by $150,000.

CORYDON, IND.—The Town Board has entered into a contract with the Interstate Public Service Company for lighting the streets of the town. Under the terms of the contract the company agrees to make improvements to the system, to cost between $15,000 and $20,000. Frank Wright is local agent of the company.

FORT WAYNE, IND.—The Board of Public Works is considering plans for extensions to the municipal electric light plant, involving an expenditure of about $25,000. If plans are approved, it is understood that bids will be asked for the new building at once.

GARY, IND.—The Gary Street Railway Company has been granted a permit for the erection of a brick substation on Jackson Street near Eleventh Avenue, to cost about $8,000. The building, which is practically completed, will be used as a transformer station for all the city lines of the company.

GOSHEN, IND.—The Indiana & Michigan Electric Company is erecting an electric transmission line from Elkhart to Ligonier for the purpose of transmitting electricity generated at Hen Island.

JEFFERSONVILLE, IND.—The United Gas & Electric Company is erecting heavy wires to Jeffersonville to supply energy to the government depot, where all surroundings are to be illuminated by electric lamps.

MARION, IND.—The United States government has awarded a contract to the Delta Electric Company for 20,000 electric lanterns of a special type for the navy.

CICERO, ILL.—The Western Electric Company of Chicago is planning to build a manufacturing building, 37 ft. by 249 ft., adjacent to a building, six stories, recently completed at its local plant.

DECATUR, ILL.—The capital stock of the Decatur Railway & Light Company has been increased from $1,375,000 to $1,600,000.

EDWARDSVILLE, ILL.—The capital stock of the Madison County Light & Power Company has been increased from $335,000 to $500,000, the proceeds to be used for extensions to its system.

MATTOON, ILL.—The Central Illinois Public Service Company of Mattoon and the Canton (Ill.) Gas & Electric Company have filed a joint petition with the Illinois Public Service Commission asking permission for the latter company to erect high-tension transmission lines from Ipava to Lewiston, and for the former company to build a transmission line from the West Havana substation, across the Illinois River from Havana, to the southern terminus of the Canton Gas & Electric Company's present line; also for the Canton Gas & Electric Company to construct a transmission line to serve the Liverpool Drainage and Levee District, and also for the approval of the commission of an incorporate working agreement between the two companies.

BEAVER DAM, WIS.—Preparations are being made by the Wisconsin Power, Light & Heat Company to use electricity from the power plants on the Wisconsin River for the local system as soon as the transmission line is completed as far as this city.

DE PERE, WIS.—The Western Steel & Manufacturing Company is considering extensions to its plant and power house, to cost approximately $25,000.

THORP, WIS.—The council is considering purchasing the local plant of the Wisconsin-Minnesota Light & Power Company of Eau Claire.

WAUSAU, WIS.—The Wisconsin Valley Electric Company is contemplating improvements to its local plant, involving an expenditure of about $100,000. M. C. Ewing is general manager.

DODGE CENTER, MINN.—Bids will be received at the office of the county auditor of Dodge County, Court House, Mantorville, until Jan. 8, 1918, for construction of county home buildings on a site approximately 1½ miles east of the city of Dodge Center, including general contract work, plumbing, heating and electrical work. Copies of plans and specifications may be obtained at the office of Alden & Harris, architects, Exchange Bank Building, St. Paul, Minn., upon deposit of $10.

HIBBING, MINN.—The Water and Light Commission is considering erecting another transmission line to supply more power to operate the pumps or the building of a steam plant at the wells south of the village.

NASHWAUK, MINN.—The municipal electric-light plant was recently destroyed by fire, causing a loss of about $2,000. An emergency steam plant is now furnishing the service. Electricity for operating the municipal system is secured from the Virginia station of the Great Northern Power Company.

WABASHA, MINN.—R. E. Jones & Company, who own and operate the local electric-lighting system, are contemplating placing its wires in underground conduits in the downtown district.

ALBURNETT, IOWA.—The local telephone exchange building was recently destroyed by fire.

ELDORA, IOWA.—The local electric-light plant, it is reported, was recently destroyed by fire.

MARSHALLTOWN, IOWA.—Preliminary plans and estimates are being prepared for the installation of new machinery in the municipal electric-light plant. The City

Council is considering the purchase of the property of the Iowa Railway & Light Company.

VAIL, IOWA.—The contract for installation of electric-lighting system has been awarded to the Electric Appliance Company of Chicago, Ill., at $8,000. An electric transmission line will be erected from the municipal plant at Denison to supply energy to operate the system.

APPLETON CITY, MO.—Preliminary plans are being prepared for extensions and improvements to the municipal electric light plant, which will involve an expenditure of about $15,000. The plans provide for the installation of new steam and electric machinery. W. B. Rollins & Company, 209 Railway Exchange, Kansas City, are engineers.

WARRENTON, MO.—The local electric-light plant has been purchased by August F. Sievert, who took possession Dec. 1.

ESMOND, S. D.—The installation of an electric-lighting system in Esmond is reported to be under consideration.

FAITH, S. D.—The installation of a municipal electric-light plant in Faith is reported to be under consideration.

BROKEN BOW, NEB.—The installation of a new engine at the municipal electric-light plant is under consideration.

WESTERN, NEB.—Contract, it is reported, has been awarded to I. E. Watenpaugh of Lincoln for construction of brick addition to power plant.

BAXTER SPRINGS, KAN.—The Empire District Electric Company is contemplating extensive improvements to its local system, including remodeling the present building and enlarging the plant.

BURNS, KAN.—At an election to be held Dec. 27 the proposal to issue $10,000 in bonds for the construction of an electric-light plant in Burns will be submitted to the voters. C. A. Beebe is city clerk.

CONWAY SPRINGS, KAN.—DeLos De Tar, owner of the local electric-light plant and ice factory, having been called in the selective draft, is planning to sell the property.

McFARLAND, KAN.—The Alma (Kan.) Light & Ice Company is now supplying electrical service in McFarland.

OAKLEY, KAN.—W. M. Pratner, it is reported, is contemplating building an ice factory in Oakley.

RANDOLPH, KAN.—The erection of an electric transmission line from the plant of the Rocky Ford (Kan.) Electric Company to Randolph is under consideration.

ROCKY FORD, KAN.—The Rocky Ford Electric Company is considering erecting an electric transmission line to Rossville to furnish electrical service there.

Southern States

FREMONT, N. C.—Bids will be received by the Mayor and Board of Commissioners, Town Hall, Fremont, until Jan. 3, 1918, for improvements to the municipal electric-light plant, consisting of 22,000-volt steel wire transmission line, about 10 miles in length, substation, arc-lamp and electric distribution systems. Plans and specifications are on file at the office of the town clerk, Fremont, and at the office of B. O. Austin, consulting engineer, Raleigh, N. C.

MARION, N. C.—The Cross Cotton Mills Company is planning to build an addition to its power plant, including the installation of an additional boiler.

ATLANTA, GA.—The City Council is considering the installation of an electric generating plant at the garbage crematory (using refuse for fuel), to cost from $60,000 to $70,000. E. R. Turner is city electrician.

BRUNSWICK, GA.—The City & Suburban Railway Company contemplates extending its car line to the shipbuilding plant of the United States Maritime Corporation.

NASHVILLE, GA.—The City Council is considering the installation of electric lamps on the public square.

WEST PALM BEACH, FLA.—The Associated Realty Investors, which is developing a residential section, 125 acres, 1 mile south of West Palm Beach, is planning to instal an electric-light system in connection with the proposed project. Alfred H. Wagg is president.

MOBILE, ALA.—The Mobile Builders' Equipment Company, recently incorporated, has acquired building and machinery for the manufacture of doors, sash, blinds and frames, etc. The company contemplates equipping the plant for electrical operation, replacing steam power. James K. Glennon, 51 North Royal Street, is president.

MONTGOMERY, ALA.—The Montgomery Light & Water Power Company is planning to erect an electric transmission line from its plant in North Montgomery to the aviation field.

FORT SMITH, ARK.—The City Council is considering a proposal submitted by the Fort Smith Light & Traction Company for a contract for lighting the streets of the city.

STUTTGART, ARK.—The City Council has granted S. R. Morgan & Company of Little Rock a franchise to construct and operate an electric-light plant in Stuttgart for a period of 50 years. Under the terms of the franchise the company must begin work within 60 days and the plant must be completed within 10 months. The company owns and operates electric-light and power plants in Beebe, Ashdown, Des Arc, El Dorado, Fordyce and Warren. It is also financing an electric transmission line from Fort Smith to Russellville, a distance of 65 miles. Energy for the line, which will supply electricity to Alma, Mulberry, Ozark, Altus, Cole Hill, Paris, Clarksville and the coal mines at Hartman and Spadra, will be purchased from the Fort Smith (Ark.) Light & Power Company. The line will be completed by the first of January.

KENNER, LA.—The Council is considering an issue of $10,000 in bonds for the installation of an electric-lighting system.

BARTLESVILLE, OKLA.—Mid-Co Gasoline Company, it is reported, is erecting a large power plant south of Bartlesville, which when completed will furnish electricity for the oil fields of Oklahoma. The cost of the plant is estimated at $2,000,000.

COMMERCE, OKLA.—The Triangle Mines Company is planning to install an electric-light and power plant in connection with its proposed 150-ton stamp mill. N. C. Barry is president.

LAWRENCE, OKLA.—Bonds to the amount of $13,000 have been voted to purchase the electric-lighting system.

NACOGDOCHES, TEX.—The City Council is considering installing additional equipment and machinery in the municipal electric-light plant. It is proposed to double the output of the plant.

RUSK, TEX.—The Texas Steel Company of Beaumont has purchased the Rusk foundry property, which includes iron furnace, pipe foundry, electric-light plant, dwellings, etc., at $112,500. The new owner it is understood, contemplates general improvements and the rehabilitation of the blast furnace.

WACO, TEX.—The City Commission has decided to install an ornamental lighting system in Waco.

Pacific and Mountain States

AUBURN, WASH.—The Valley Gas Company, which was recently granted a franchise in Auburn, it is understood, will begin work on the installation of the system as soon as materials can be secured.

CLE ELUM, WASH.—The City Council is negotiating with the Northwestern Improvement Company to furnish electricity for lamps and motors in the South Cle Elum Addition, lying on the south side of the Yakima River. It is proposed to make an extension from the South Cle Elum system.

SEATTLE, WASH.—The Board of Public Works has awarded the Baker-Joslyn Company the contract for supplying the city with 85,500 ft. of copper for the lighting department, at $23,927.

SPOKANE, WASH.—The Doerr-Mitchell Electric Company has been awarded the contract for the installation of the lighting system in the new Crescent store. The plans provide for about 375 fixtures to cost about $4,000. The company recently secured the contract for equipping the new Grant County court house at Ephrata with electrical fixtures, at $1,200.

TACOMA, WASH.—The City Council has decided to submit the proposal to issue additional bonds to buy and develop a power site to the voters next spring.

WASHOUGAL, WASH.—The County Commissioners have granted the Northwestern Electric Company a franchise to extend its transmission lines in Washougal and also in Oak Park.

WHITE SALMON, WASH.—The Pacific Power & Light Company has purchased two lots in White Salmon on which it proposes to erect a large station.

BEND, ORE.—Plans have been prepared by the White Pine Lumber Company of Bend for the construction of a lumber mill at Pringle Falls. The proposed plant will have a daily capacity of 80,000 ft. and will cost about $140,000. The plans also provide for building a hydroelectric power plant of 2250 hp.

HALFWAY, ORE.—An electric-lighting system, it is expected, will be installed in Halfway as soon as the transmission line reaches the edge of the valley.

ALPAUGH, CAL.—The San Joaquin Light & Power Company has begun work on the erection of a new substation, to be located 4 miles south of Alpaugh. A high-tension transmission line will be extended from Corcoran.

FAIROAKS, CAL.—Application has been made to the State Railroad Commission by R. A. Rose, owner of the local electric plant, to execute a promissory note for $5,500, the proceeds to be used to take up former notes and to pay for additions and improvements to the plant.

FORT BRAGG, CAL.—The Fort Bragg Electric Light Company has decided to install meters throughout its entire system. Additional street lamps will be erected where necessary.

FRESNO, CAL.—The Fresno Interurban Railway Company is contemplating the construction of an extension from Sunnaid to Centerville, a distance of 7 miles, through a new orange district.

LOS ANGELES, CAL.—The Southern California Edison Company has been awarded a contract by the Board of Supervisors to furnish electricity for lighting the El Modena, Garden Grove and Tustin lighting districts with electricity.

LOS ANGELES, CAL.—The United Power Company of Los Angeles, which has acquired the properties of the Electric Power Company in San Gabriel Canyon, it is reported, contemplates the construction of a new power plant at Iron Fork.

MODESTO, CAL.—Improvements are being made to the Modesto plant of the Sierra & San Francisco Power Company, which will cost about $30,000.

SAN BERNARDINO, CAL.—Improvements and extensions are under way by the Southern California Edison Company, which will involve an expenditure of about $200,000 and will include the construction of a joint pole line with the Southern Sierras Power Company out of E Street, rebuilding of many lines within the city, erection of a new "tie-in" line from the Fontana Company's power plant north of Rialto, and a new line along Base Line into this city, in addition to a new line to connect with the Mentone line and a connection with the 60,000-volt line from the Long Beach plant, and the construction of a warehouse and service headquarters at 240 E Street.

SAN FRANCISCO, CAL.—Plans are being prepared for the construction of a new shipbuilding plant for the Pacific Coast Shipbuilding Company, which will include slips, docks, power plant, foundry and a number of machine shops, to cost about $500,000, in the upper bay near Port Costa. Frederick H. Meyer is architect. Henry T. Scott, telephone executive and former owner of the Union Iron Works, is interested in the company.

MISSOULA, MONT.—The Northern Pacific Railway Company is installing a telephone system between the headquarters of the Rocky Mountain division in Missoula and Livingston, and points east, as well as Spokane and coast points. The company, it is stated, plans ultimately to institute communication between St. Paul and Tacoma. The present project calls for connection of 42 stations by telephone.

Canada

VICTORIA, B. C.—Plans have been filed with the registrar of joint stock companies by the British Columbia Telephone Company for laying another submarine telephone cable across False Creek. The work, it is understood, will begin within the next few weeks.

BRIDGEBURG, ONT.—The Board of Aldermen has authorized Mayor Atwood to enter into a contract with the Canadian Niagara Power Company of Niagara Falls for energy to operate the new duplex pumps in the municipal pumping station.

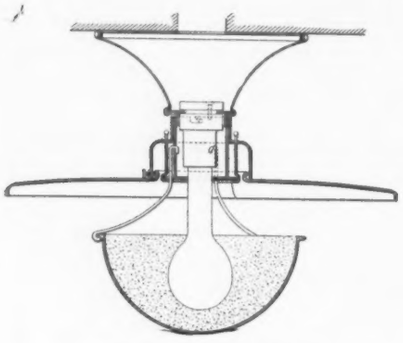
ST. CATHARINES, ONT.—Work is progressing on the construction of the Chippewa Hydroelectric Power Canal which will carry water from the Niagara River at Chippewa through the Chippewa River to Queenstown. When completed this canal will supply 900,000 hp.

TORONTO, ONT.—Extensions to the power plant of the Ontario Power Company, involving an expenditure of over $1,000,000, and which will make available 25,000 additional hp. by July next and another 20,000 hp. within the next three or four months has been decided upon by the Hydro-Electric Power Commission of Ontario. All contracts will be made through the Ontario Power Company for the Hydro-Electric Power Commission.

1,248,444. Regulating Device; Porter H. Brace, Pittsburgh, Pa. App. filed March 8, 1917. For controlling mechanisms or apparatus in accordance with predetermined conditions.

1,248,457. Mechanism for Operating Railway Signals; James W. Coffman, Springfield, Ill. App. filed May 3, 1915. Improvement.

1,248,459. Ignition Mechanism; Frank Conrad, Pittsburgh, Pa. App. filed April 3, 1914. Improvement.



1,248,187—Lighting Fixture

1,248,461. Electromagnetic Device; Gustavus C. Crawford, East Orange, N. J. App. filed Nov. 17, 1916. Pole changers.

1,248,466. Telephone-Exchange System; Bert G. Dunham, Hawthorne, N. J. App. filed July 20, 1915. To provide a simple circuit arrangement for selector switches and to insure the proper selecting operation of such switches.

1,248,469. Signal; William F. Egelhofer, New York, N. Y. App. filed Aug. 10, 1916. For automobiles.

1,248,474. Alternating-Current Motor; Valere A. Flynn, St. Louis, Mo. App. filed Dec. 15, 1916. Simple means for adjusting the speed of such motors.

1,248,479. Automatic Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed Sept. 7, 1915. Means for inserting in an automatic telephone exchange system an overflow finder which acts as a substitute for or duplicate of the finder with which it may be associated.

1,248,484. System of Distribution; Arthur J. Hall, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Direct-current railway systems.

1,248,495. Electrode for Slip Regulators; George W. Huey, Wilkinsburg, Pa. App. filed June 18, 1913. Provides an electrode having a structure upon which bubbles have practically no tendency to adhere, while the dispersal of the bubbles is uniform and at a rate corresponding to their formation.

1,248,497. Vapor-Electric Apparatus; Ray P. Jackson, Edgewood Park, Pa. App. filed April 6, 1914. Applies to the structure of the wall of such apparatus in the neighborhood of the electrodes.

1,248,498. Suspension Device for Insulators; Ray P. Jackson, Edgewood Park, Pa. App. filed Dec. 4, 1915. Readily separable.

1,248,508. Electric Switch; Pierre L. Leisse, Billancourt, France. App. filed Dec. 1, 1913. For use in combination with variable-speed dynamo-electric machines to maintain the voltage of the dynamo substantially constant.

1,248,511. Ammeter; Paul M. Lincoln, Pittsburgh, Pa. App. filed May 16, 1914. May serve as a maximum-demand meter also.

1,248,512. Brake Apparatus; David L. Lindquist, Yonkers, N. Y. App. filed July 7, 1914. Electric elevator.

1,248,515. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Oct. 2, 1916. Adapted to service in multi-office districts.

1,248,519. Starting Switch; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Feb. 21, 1914. Means for stopping the movable-contact member in each of its correct successive positions.

1,248,527. Electrical Measuring Instrument; Walter G. Mylius, Wilkinsburg, Pa. App. filed Aug. 9, 1916. Light-load adjusting devices for such instruments.

Record of Electrical Patents

Notes on United States Patents issued on December 4, 1917

1,248,528. Clamp-Type Terminal; Harry C. Nagel, Wilkinsburg, Pa. App. filed Feb. 7, 1916. Large current-carrying capacity which requires a few bolts only.

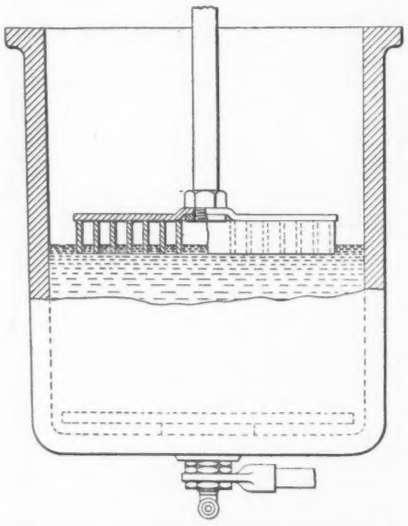
1,248,531 Balancing Means for Phase-Converting Systems; Stanley G. Nottage, Wilkinsburg, Pa. Application filed Dec. 9, 1916. Improvement.

1,248,544. Method of Making Electric-Switch Jaws and the Like; Karl C. Randall, Edgewood Park, Pa. App. filed April 12, 1915. Improvement.

1,248,559. High-Tension Suspension Insulator; Edson O. Sessions, Chicago, Ill. App. filed July 10, 1916. For high-tension wireless work.

1,248,566. Electrical Device; Frank M. Slough, Elyria, Ohio. App. filed May 13, 1915. In connection with telephone signaling systems.

1,248,568. Single-Phase Power-Factor-Measuring Device; Benjamin M. Smith, Turtle Creek, Pa. App. filed July 3, 1914. Adapts a polyphase power-factor meter for operation on a single-phase circuit.



1,248,495—Electrode for Slip Regulators

1,248,569. Electrical Appliance for Conduit Outlet Boxes; Floyd D. Smith, Syracuse, N. Y. App. filed May 6, 1911. Improvement.

1,248,572. Switch Lock; Arvid P. Sunnergren, Pittsburgh, Pa. App. filed Nov. 18, 1915. Improvements.

1,248,574. Brush-Holding Device; Egbert M. Tingley, East Orange, N. J. App. filed Feb. 7, 1917. Formed substantially of punched parts.

1,248,575. Snap Switch for Sadirons and the Like; Samuel Trood, Edgewood Park, Pa. App. filed Jan. 28, 1913. Improvement.

1,248,603. Panelboard Construction; Frederick L. Benzon, Plainville, Conn. App. filed May 12, 1916. Facilitates the assembling of the panel units or sections.

1,248,612. Distributer Arm; John F. Cavanagh, Meriden, Conn. App. filed June 11, 1912. Ignition apparatus.

1,248,624. Electric Regulation; John L. Creveling, New York, N. Y. App. filed Jan. 15, 1910. Automatic.

1,248,632. Polyphase Electric Furnace; Joseph L. Dixon, Detroit, Mich. App. filed Jan. 20, 1917. Control.

1,248,637. Electric Log; Lloyd C. Eddy, Buffalo, N. Y. App. filed Dec. 4, 1916. Improvements.

1,248,638. Flame-Proof Insulating Composition; Carleton Ellis, Montclair, N. J. App. filed Aug. 5, 1915. Improvements.

1,248,663. Speed-Controlling Mechanism for Block-Signal Systems; Marsena R. Julian, Birmingham, Ala. App. filed April 22, 1915. Improvements.

1,248,688. Portable Electric Lamp; Engelbert Ludescher, Chicago, Ill. App. filed May 16, 1917. Can be used as a flashlight, lantern, electric torch or candle, and the like.

1,248,699. Terminal Box; Chester C. Oberly, Chicago, Ill. App. filed March 10, 1916. For train lighting.

1,248,719. Signal Lamp; Gordon E. Roedding and Edward B. Roedding, Detroit, Mich. App. filed Dec. 21, 1914. For motor vehicles.

1,248,738. Engine-Resting Device; William E. Somerville, Coal City, Ill. App. filed Jan. 27, 1916. Combined in a single structure and arranged in a convenient position for the operator.

1,248,741. Safety Device for Electrical Circuits; Maximilian H. Spielman, New York, N. Y. App. filed March 23, 1916. In connection with burglar alarms on windows.

1,248,848. Self-Starting Device for Storage-Battery Plants; Julius H. Gugler, Milwaukee, Wis. App. filed May 16, 1913. Improvement.

1,248,868. Semi-Automatic Telephone-Exchange System; Morton L. Johnson, Chicago, Ill. App. filed May 6, 1910. Provides a cord circuit of universal utility which may be used between different kinds of telephone lines and which will automatically adjust itself.

1,248,870. Engine Starter; John J. Kane, Milwaukee, Wis. App. filed Feb. 9, 1914. Motor vehicles.

1,248,877. Spark-Plug Tester; William D. Luce, Haverhill, Mass. App. filed Jan. 31, 1917. Adaptable to different conditions of use and also susceptible of reduction in size.

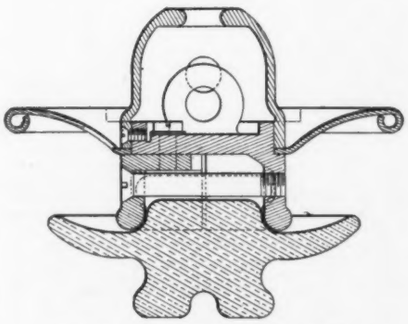
1,248,894. Electric Thermostat; Charles L. Norwood, Philadelphia, Pa. App. filed May 2, 1917. Improvements.

1,248,927. Electric Welding Apparatus; Gustave H. Schkommodau, Cincinnati, Ohio. App. filed Oct. 2, 1916. For welding metal in sheet form.

1,248,934. Pocket Flashlight; Edward W. Seymour, New York, N. Y. App. filed Sept. 23, 1916. Suitable casing.

1,248,942. Electric Detector Circuit; Frank J. Sprague, Sharon, Conn. App. filed Dec. 31, 1914. Improvements.

1,248,968. Automobile-Lighting Apparatus; Frank E. Wilson, London, England. App. filed Nov. 28, 1914. Combined switch and meter box.



1,248,559—High-Tension Suspension Insulator

1,248,978. Attachment Plug for Connecting Dry Cells to Incandescent-Lamp Holders; Charles E. Youmans, Yonkers, N. Y. App. filed Nov. 23, 1915. Improvements.

1,248,979. Telephone-Exchange System; Frederick V. Young, Newark, N. J. App. filed Feb. 17, 1917. Signaling means.

1,248,998. Microphonic Attachment for Telephone Transmitters; Walter C. Bellows Chicago, Ill. App. filed July 12, 1916. Means by which whispered speech will be rendered clearly audible.